

VOLUME XLI

NUMBER 1

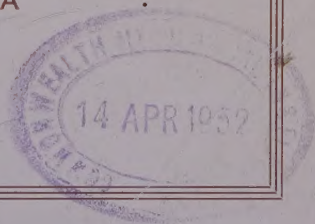
STATE OF CALIFORNIA
DEPARTMENT OF AGRICULTURE



BULLETIN

SACRAMENTO, CALIFORNIA

JANUARY-FEBRUARY-MARCH
1952



STATE OF CALIFORNIA

EARL WARREN, *Governor*

DEPARTMENT OF AGRICULTURE

ADMINISTRATION

A. A. BROCK, *Director*
C. U. DUCKWORTH, *Assistant Director*
W. C. JACOBSEN, *Assistant to Director*
WM. H. GRAVES, *Departmental Accounting Officer*
CHAS. F. CUSICK, *Personnel Officer*
CHARLES H. KINSLEY, *Regional Coordinator, San Francisco*
JOHN B. STEINWEDEN, *Regional Coordinator, Los Angeles*
ROMAIN YOUNG, *Regional Coordinator, Sacramento*
CLIFFORD CLOWER, *Agricultural Technician*
MERLE HUSSONG, *Agricultural Information Assistant*
EDNA WILLIS GASKILL, *Editorial Assistant*

DIVISION OF PLANT INDUSTRY

CHAS. V. DICK, *Chief*

BUREAU OF ENTOMOLOGY

H. M. ARMITAGE, *Chief*

BUREAU OF PLANT QUARANTINE

A. P. MESSENGER, *Chief*

BUREAU OF PLANT PATHOLOGY

GILBERT L. STOUT, *Chief*

BUREAU OF RODENT AND WEED CONTROL AND SEED INSPECTION

WALTER S. BALL, *Chief*

BUREAU OF FIELD CROPS

V. O. WOLCOTT, *Chief*

BUREAU OF CHEMISTRY

ALLEN B. LEMMON, *Chief*

DIVISION OF ANIMAL INDUSTRY

DR. A. K. CARR, *Administrator*

BUREAU OF LIVESTOCK DISEASE CONTROL

DR. A. K. CARR, *Chief*

BUREAU OF MEAT INSPECTION

DR. G. A. BOYD, *Chief*

BUREAU OF DAIRY SERVICE

O. A. GHIGGOILE, *Chief*

BUREAU OF LIVESTOCK IDENTIFICATION

LOGAN D. MORTON, *Chief*

DIVISION OF MARKETING

C. J. CAREY, *Chief*

BUREAU OF MARKETS

W. J. KUERT, *Chief*

BUREAU OF MARKET ENFORCEMENT

J. C. HARLAN, *Chief*

BUREAU OF MARKET NEWS

GEORGE K. YORK, *Chief*

BUREAU OF MILK CONTROL

BRUCE J. CAMPBELL, *Chief*

BUREAU OF AGRICULTURAL STATISTICS

GEORGE A. SCOTT, *Chief*

BUREAU OF FRUIT AND VEGETABLE STANDARDIZATION

H. W. POULSEN, *Chief*

BUREAU OF SHIPPING POINT INSPECTION

W. F. ALLEWELT, *Chief*

BUREAU OF WEIGHTS AND MEASURES

J. E. BRENTON, *Chief*

VOLUME XLI

NUMBER 1

STATE OF CALIFORNIA
DEPARTMENT OF AGRICULTURE



BULLETIN

SACRAMENTO, CALIFORNIA

JANUARY-FEBRUARY-MARCH

1952

THE BULLETIN

Official Bulletin of the Department of Agriculture, devoted to Agriculture in its broadest sense. Sent free to citizens of California and offered in exchange for bulletins of the Federal Government, Experiment Stations, and other publications of a similar nature. Published Quarterly.

A. A. BROCK	Director
EDNA WILLIS GASKILL	Editor

Entered as second-class matter, October 6, 1919, at the post office at
Sacramento, California, under the act of June 6, 1900

Vol. XLI	JANUARY-FEBRUARY-MARCH	No. 1
----------	------------------------	-------

CONTENTS

	Page
Strawberry Plant Certification and Registration in California— <i>Stanley M. Mather</i>	3
Miscellaneous Diaspidid Scale Studies, Part IX— <i>Howard L. McKenzie</i>	9
Apricot Powdery Mildew From Rose and Peach— <i>C. E. Yarwood</i>	19
Atmospheric Fumigation of Various Seeds With Methyl Bromide— <i>Earle T. Gammon</i>	27
Eriophyid Studies, XVIII— <i>H. H. Keifer</i>	31
Gorse Control— <i>Murray R. Pryor and Richard H. Dana</i>	43
Insect Notes—	47

STRAWBERRY PLANT CERTIFICATION AND REGISTRATION IN CALIFORNIA

By STANLEY M. MATHER

Assistant Supervisor of Nursery Service, California Department of Agriculture

Virus diseases of strawberry plants such as yellows and crinkle, any one of several species of nematodes, or red stele disease, when introduced into a commercial strawberry growing area may become a limiting factor in the useful productiveness of an expensive planting. For several years it has been recognized that symptoms of yellows and crinkle of strawberry are produced by a combination of virus components rather than by any single virus entity. Detection of yellows and crinkle quite often is difficult in field inspection. It depends on certain seasonal conditions and stages of growth of the strawberry plants. Plants infected with only one component of the strawberry virus complex have not, in our experience, revealed any symptoms recognizable as a virus symptom under field conditions. Even though plants infected with only a part of the virus complex may grow thriftily as would a virus-clean plant, the hazard of their becoming rapidly encumbered with a serious combination of virus components is apparent when grown in an area with strawberries originating from a different source and containing one or more other components. A practical means of combating this problem lies in the establishment of a clean source of planting stock. It is possible to produce, under conditions of isolation, plants which can be certified as clean.

The first official strawberry plant certification in California was started in 1941 by the California Department of Agriculture, Bureau of Plant Pathology, in cooperation with B. F. Stroup, Agricultural Commissioner of Shasta County. This program was based on information derived from the research of Dr. Harold E. Thomas, then of the Division of Plant Pathology of the University of California, who was instrumental in guiding the development of the program. The field work and certification details were carried out by Mr. Stroup who in previous years had worked closely with Dr. Thomas in Shasta County.

In 1949 the present program was adopted at the request of strawberry plant growers. It was assigned to Nursery Service to administer with the technical assistance and counsel of the Bureau of Plant Pathology. Fees were established to place the program on a self supporting basis as provided in Section 120.5 of the California Agricultural Code. J. Lee Hewitt, then Supervisor of Nursery Service, now retired, was responsible for incorporating the previous ideas with indexing, thus leading to the development of the program of certification and registration now in effect. Advice and counsel was sought and generously given by Dr. Harold E. Thomas, Director of the Strawberry Institute; B. F. Stroup; D. G. Milbrath, formerly Chief of the Bureau of Plant Pathology, now retired; Gilbert L. Stout, Chief of the Bureau of Plant Pathology; staff members

of the University of California and experienced California strawberry plant growers. The program as adopted includes low tolerance on virus in stock certified, freedom from certain nematodes and red stele disease, intensive pest control roguing, isolation and plant indexing.

Certification is based on a two-year inspection period. Four field inspections of a mother bed planting are required within a year, three during the growing season for virus diseases and other pests and a fourth at digging time for root diseases and nematodes. To supplement the field inspection a sample of strawberry plants from the mother bed may be tested by grafting to healthy virus-free indicator plants in a greenhouse. The plants produced in the mother bed within established pest tolerances are permitted to be planted in an increase field the following season. Three field inspections are then required of this planting. Two are made during the growing season and one at digging time. Upon meeting all the conditions prescribed by the regulations, the plants produced from the increase field are eligible for certification and may be sold as California Certified Strawberry Plants.

Indexing commercial varieties by grafting to virus-free strawberry plants of a highly susceptible species is a means of detecting the presence of virus disease by the expression of symptoms in the susceptible indicator plants. By using this method, a source of plants considered to be virus-free may be established. In view of this, an amendment to the regulations to provide for a registry of foundation stock was adopted in 1951. All plants registered, or produced from registered foundation stock and certified as such, originate from plants actually indexed and found free of virus disease. Plants entered for registration must be started in a small mother bed comprised of 15 plants. The runner plants produced in this small bed are then planted the following year in a registry mother bed. The production of this bed may be registered and serve as foundation stock for planting in an increase bed for the production of California Certified Strawberry Plants from Registered Foundation Stock. The registration program parallels the certification program as to field inspection and has the additional requirement that the source plants first be proved virus-free by the one year in the index bed.

Indexing plants has been found to be of particular interest and value to the program. The technic of stolon grafting was demonstrated to us by Dr. Harold E. Thomas. It was found to be practical on a large scale within reasonable economic limits. The indicator plant used is a species of native strawberry tentatively identified as *Fragaria bracteata* (Fig. 1). There is some opinion that this species is a variety of *F. vesca* which is in more general use as an indicator plant elsewhere in the United States and England. The susceptibility of *F. bracteata* to some of the virus components of the yellows and crinkle group has been well demonstrated to us by Dr. Norman Frazier of the University of California and Dr. Harold E. Thomas.

The indexing is accomplished by grafting a stolon of the indicator plant to a stolon of the variety strawberry plant to be tested. The graft applied is a tongue graft. The selection of stolons as to stage of growth is of importance. The stolons of the variety plant best suited are those in an active stage of growth. Once the stolon has extended itself 8 to 12 inches in length and before its terminal bud expands, conditions for a successful graft are usually present. If the stolon becomes hardened off

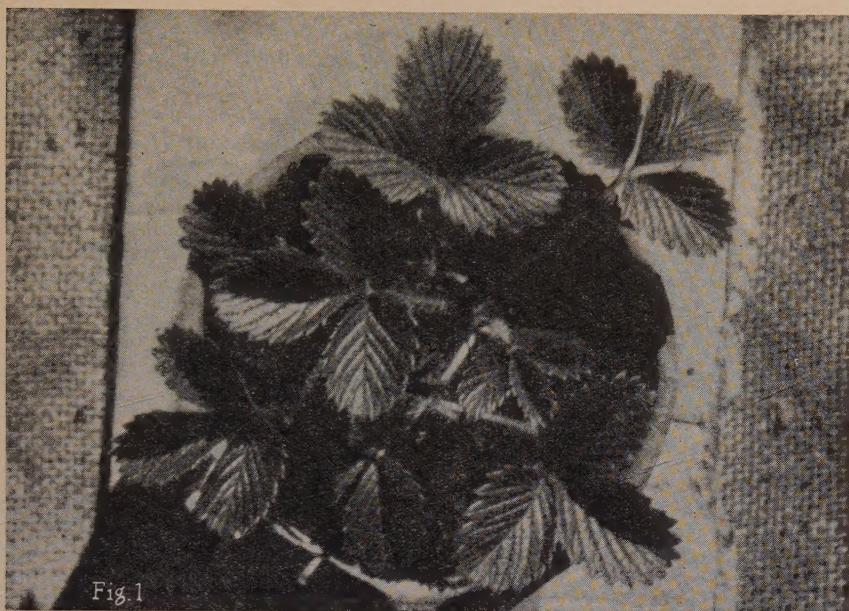


Fig. 1



Fig. 2

FIGURE 1. Healthy *Fragaria bracteata*.FIGURE 2. Virus expression in *Fragaria bracteata* 64 days after grafting to a variety plant. Note flattening of plant with rosetting, dwarfing and distortion accompanied by mottle. Normal appearing leaves of variety plant visible adjacent to pot.

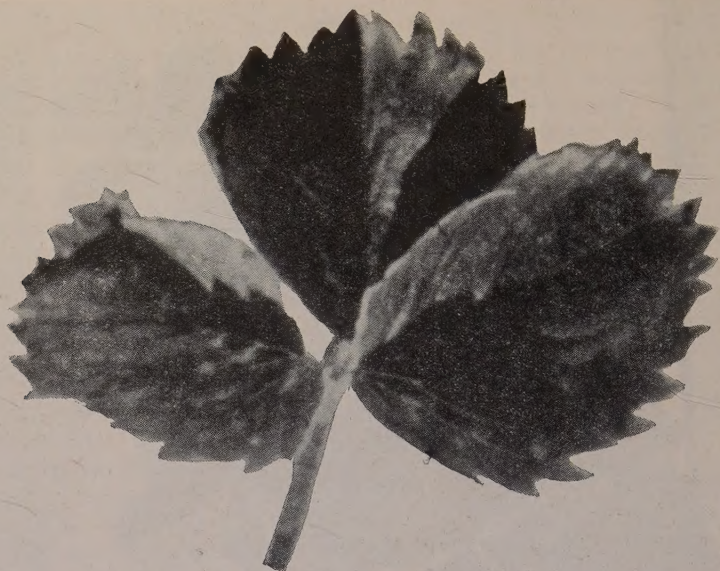


FIGURE 3. Young leaf of variety plant showing flecking or spotting.

and the terminal bud has expanded it then becomes desirable to wait until the continuation of the growth of the stolon has provided another tip suitable for grafting. The small diameter of the *F. bracteata* stolons as compared to the variety stolons may add to the difficulty of making a successful graft. By proper fertilization the diameter of these stolons may sometimes approach that of the variety stolons, creating a situation more conducive to successful grafts.

The tips of the indicator stolons are likewise in best condition for grafting just prior to the expansion of the terminal bud. The color of the stolon will be green at the extreme tip, shading to pink perhaps one to two inches back of the tip. The distance the cuts should be made from the tips of the stolons may vary depending on the degree of their maturity. To properly locate the place where the cuts should be made the two stolons should be brought together with tips pointed in the same direction so that they coincide without strain or twisting.

Preparation for the incisions should then be made by carefully peeling the epidermis off the stolon at the point where the cuts are to be made. This step has been found necessary. Presumably this creates six surfaces that may form callus and so unite. Using stolons in the most desirable condition, the cuts are most often made about one to two inches from the tip. The procedure followed is to make the first cut on the variety stolon in the direction of the plant. The longitudinal cut should be approximately one-quarter to five-sixteenths inch in length slanting towards the center of the stolon until the cutting edge meets resistance. The same type cut is made on the stolon of the indicator plant only in opposite direction, the cut being made toward the tip of the stolon. Upon fitting the tongues together, the graft is bound by means of a self-sealing rubber tape. Since the indicator plant stolon is the more delicate of the two, the tape should

be pinched together exerting firm pressure on the side of and towards the variety stolon. The strips cut from the roll of tape should not be wider than the length of the tongues cut. To prevent strain on the union or possible twist of the tongues out of position a very light fiber covered wire is loosely spiraled around both stolons approximately two to four inches back of the graft. Due to the rapid and uneven elongation of the stolons the graft sometimes will be broken by a mechanical bow string effect if this wire is pinched too tight.

After a period of 10 days from the time of making the graft the tape may be removed for inspection purposes. If the graft is successful a very strong callus formation usually is in evidence. Some grafts may be more delicate than others, the union being apparent only at the extreme tip of one tongue. After inspection for union a narrow strip of tape may be placed over the graft to protect from accidental severage. The plants are left so joined for a period of 60 days after which time the indicator plant and its second daughter plant forward of the graft, previously rooted in a pot, are severed from the variety plant. Both of these plants are retained for readings. In order to verify the success of the graft union, the first daughter of the indicator plant forward of the graft is left attached to the variety stolon and unrooted. If the graft did not make union there will be a rapid wilting of the leaves of the daughter left so attached. If the graft was successful this daughter of the indicator plant will continue to live.

During 1951, six mother beds consisting of Marshall, Lassen and Shasta varieties were entered in the certification program. Five index beds of Marshall, Lassen and Shasta, consisting of 15 plants each were entered in the registry program. One 35-acre increase bed of the Marshall variety is currently under inspection for certification.

The use of indicator plants for the sample testing of the mother beds resulted in the rejection for excessive virus of three mother beds submitted for certification. Of the plants sampled from these three beds which were successfully grafted, 88.37 percent transmitted virus symptoms to the *F. bracteata* (Fig. 2). The symptoms as expressed in the *F. bracteata* indicated the presence of a virus component which, in combination with other virus components, would produce yellows or crinkle disease in the variety strawberry plant. The interval of time from inoculation to development of symptoms varied from 18 to 50 days. Symptoms recognizable as being characteristic of virus infection generally were produced in about 30 or more days.

Field inspections of the three rejected beds failed to reveal any indication of virus symptoms except for six plants exhibiting symptoms of yellows, found in two of the three beds. Under the cool conditions of our greenhouse location near Berkeley nearly all of the plants of the sample group from these beds at one time or another developed a flecking or spotting in the young leaves before they reached maturity (Fig. 3). This flecking was not due to insect feeding since insects including aphids, white flies, mealybugs and spider mites were excluded by means of parathion sprays. Plants from other beds of the same and other varieties grown under identical conditions in the greenhouse did not exhibit these symptoms. Since this expression was of similar nature to that expected to be produced by virus and in view of the high percentage of infection determined in the lot by indexing, it was thought that the flecking may

have been caused by the virus so detected. A search was made for this particular symptom in the three rejected mother beds but it could not be found in the field.

Index testing of samples from other mother beds, one each of Marshall, Lassen and Shasta, did not reveal any virus infection. The Marshall bed under test was from stock that had been under observation since 1949 and certified in 1950 and 1951. This particular mother bed was clon planted. Of the 50 clons represented, 40 plants, each being from a separate clon, were successfully grafted.

Five index beds entered in the registry program, one of Marshall and two each of Shasta and Lassen, have been established by indexing in 1951. Plants produced from these small index beds will be clon planted in registry mother beds in 1952. If these five beds pass inspection during the 1952 season and the plants produced in them are registered, then Certified Strawberry Plants from Registered Foundation Stock grown in increase beds in 1953 may be available for market by the spring of 1954.

From experience gained this year in the strawberry index and inspection work, it appears important that indexing should supplement field inspection in a program of strawberry certification to achieve the desired results. The use of the indicator plant *Fragaria bracteata* or *F. vesca* has proved to be instrumental in the detection of latent virus infection. It seems feasible to set up a source of virus-free planting stock and to maintain that virus freedom by means of adequate isolation and continued indexing. The present plant registry phase recently incorporated in the regulations governing the Strawberry Plant Certification Program is designed to achieve this goal. Plants produced and certified under the program should invite the attention of strawberry growers desiring clean plants true to the variety names.

FOOTNOTE: The writer wishes to express appreciation for the helpful assistance of Gilbert L. Stout, Chief, Bureau of Plant Pathology, in the preparation of this article.

NEW PARLATORIINE SCALES FROM INDIA AND EGYPT, AND SUPPLEMENTARY NOTES ON OTHER RELATED SPECIES (Homoptera; Coccoidea; Diaspididae)

SCALE STUDIES—PART IX

By HOWARD L. MCKENZIE
State Department of Agriculture
Sacramento, California

In 1945 the author published a "Revision of *Parlatoria* and Allied Genera," and made predictions that many other species of this group would be found in the Oriental region and its subregions. This forecast is being substantiated by recent collections made by Dr. A. M. Boyce, Entomologist of the University of California, Citrus Experiment Station, Riverside, California, who was in India and adjacent areas for most of 1951, for the purpose, among other things, of searching for parasites of the olive parlatoria scale, *Parlatoria oleae* (Colvée). This scale insect is a very serious pest to California agriculture.

The California State Department of Agriculture has been cooperating with the University of California and Dr. Boyce by determining the scale specimens collected in Ceylon, India, Africa and adjoining regions. Among many collections made by him a species found in the Darjeeling, West Bengal area in India, is here described as a new *Parlatoria*. Another diaspidid scale which he picked up at Cairo, Egypt is named as a new form of *Parlatoresopsis*.

In addition to the descriptions of new scale species noted above, the present article includes synonomical notes on certain Parlatoriine species, and presents a revised "key to *Parlatoria* species" which will accommodate Ferris' recently described (1950) *Parlatoria yunnanensis* as well as the species herein named as new.



Dr. A. M. Boyce, Entomologist of the University of California, who was responsible for collecting many different lots of scale insects during his diligent search for parasites of the olive parlatoria scale, *Parlatoria oleae* (Colvée), on the Asiatic and African Continents. Some of the scales were little known, or entirely new species, related to the olive parlatoria scale. A few have been treated in the present article.

Considerable additional scale material collected on the Asiatic continent by Boyce has yet to be prepared and examined under the microscope. Perhaps other related *Parlatoriine* species will be found when these various lots have been determined.

Parlatoria boycei McKenzie, new species. Figure 1

The author takes considerable pleasure in dedicating this species after Dr. A. M. Boyce who made the initial survey in India which led to the discovery of the scale, and who has made a particular effort to collect and send quantities of interesting diaspidid scale insects from the Indian area, mostly.

HOSTS AND DISTRIBUTION. Type and paratypes collected on pear at Darjeeling, West Bengal, India, April 26, 1951 by A. M. Boyce and Norman Waters. Boyce indicated by correspondence that the species was rare, and as a consequence only a few specimens were collected. Ten mounted examples have been recovered from this particular lot.

HABIT. Occurring on the stems. Scale of the female approximately 2.25 mm. long, 1.50 mm. wide, oval, moderately convex, white or gray, with brownish to brownish-black exuvia, second exuvia not exceptionally large, more or less covered with wax. Scale of the male not observed and possibly non-existent.

RECOGNITION CHARACTERS. Adult female as mounted approximately 1.50 mm. long, and 1.25 mm. wide. Submarginal dorsal macroducts numerous, observed range from 124 to 151 on each side, average of 139.70, and arranged as shown on accompanying illustration. Microducts arranged as shown in figure. Three pairs of well developed pygidial lobes present, all similar, broad and stout, and noticeably notched on outer margin, slightly so on inner margin. Fourth and fifth pygidial lobes represented usually by a slight sclerotized serrate spur. Plates between median lobes narrow, almost parallel-sided, apically fimbriate, not exceeding length of inner-most lobe, the usual number occurring between the lobes with the exception of four (4) between the third and fourth lobes. Anal opening relatively large and situated at about one-half of the length of the pygidium from the pygidial apex. Vulva located on same plane as anal opening. Perivulvar pores in five (5) groups, very numerous, the anterior median group containing from 3 to 12 pores, with an average of 8.5; anterior laterals from 30 to 49 pores each, average 41.93; posterior laterals from 30 to 59, average 47.92, total number ranging from 138 to 218, with an average of 187.83. Prosoma membranous, with ventral duct tubercles as follows: prespiracular 5 to 11, anterior spiracular 8 to 11, intermediate from 8 to 10, posterior spiracular 6 to 10 and first abdominal 6 to 11. Eyespot obscure. Anterior spiracle accompanied by 8 to 13 multilocular disk pores.

NOTES. In the persistent occurrence of four apparent pygidial plates between the third and fourth lobes, this species most closely resembles *Parlatoria oleae* (Colvée) and *P. multipora* McKenzie. It differs from *oleae* by having a larger anal opening situated about mid-pygidium and a ventral vulva in the same position, whereas in *oleae* the anal opening is smaller and situated about one-third of the length of the pygidium from pygidial apex, and the vulva is located approximately mid-pygidium. In addition, *Parlatoria boycei* possesses more numerous perivulvar pores and submarginal dorsal pygidial macroducts. The absence of a male scale in the type material of *boycei* may be still another difference between this

species and *oleae*. *Parlatoria multipora* differs from *boycei* in the nature of the pygidial plates which are broad at the base and taper abruptly to a point at apex, and the ventral vulva which is not situated on the same plane as the anal opening.

This species was described from rather limited material, there being only 10 specimens mounted on seven microscope slides. The type specimen of this species will be deposited in the United States National Museum, Washington, D. C., and remaining paratypes in the State Department of Agriculture collection at Sacramento, California, and in the author's own collection.

Parlatoria crypta McKenzie

1943. *Parlatoria crypta* McKenzie, State of California, Department of Agriculture, Bulletin 32:156; figure 8.
 1943. *Parlatoria morrisoni* McKenzie, State of California, Department of Agriculture, Bulletin 32:157; figure 9.

Several collections of *Parlatoria crypta* have been made in India during 1951 by A. M. Boyce. As a result of these findings it has been determined that the range of variation of certain morphological characters (especially the intermediate spiracular, posterior spiracular, and first abdominal ventral duct tubercles) is so great that *Parlatoria morrisoni* McKenzie is here regarded as a synonym of *P. crypta* McKenzie.

Collections of *P. crypta*, on oleander, in India made by Boyce are as follows: Allahabad, April 14, 1951 (W. B. Hayes also helped in making this collection); Agra, May 20, 1951; Lyallpur, West Bengal, Pakistan, June 15-16, 1951; Moradabad, May 25, 1951, and Amritsar, East Punjab, June 2, 1951. The species was also taken on olive at Lyallpur, West Bengal, Pakistan, June 15-16, 1951. Many additional Indian collections made by Boyce are yet to be mounted, and perhaps other hosts and localities of *crypta* will be added to the above when these are examined.

To date *Parlatoria crypta* has been taken in India on the following hosts: *Euonymus* sp., *Laurus nobilis*, *Mangifera indica*, *Mallotus philippinensis*, "Lasura" leaf, *Nerium oleander*, olive and an undetermined host.

Parlatoreopsis perplexus McKenzie, new species. Figure 2

Heavy infestations of this scale showing evidences of parasitism were collected by Boyce while he was surveying for parasites of *Parlatoria oleae* (Colvée). Dr. Boyce originally recognized the species in the field as something quite different than he had ever seen. The species is here described as new.

HOSTS AND DISTRIBUTION. Type and paratypes collected on *Nerium oleander* (oleander) at Cairo, Egypt (on grounds of Heliopolis Palace Hotel), September 20, 1951 by A. M. Boyce. Additional paratype specimens are in the author's collection labelled as *Parlatoreopsis chinensis* (Marlatt) taken on *Cassia fistula* at Lahore, India, September, 1911, by R. S. Woglum.

HABIT. Occurring on the stems. Scale of the female approximately circular and about $1\frac{1}{4}$ mm. in diameter, gray, thin, flattish, with a greenish-brown exuvia at one end, second exuvia not exceptionally large, usually covered with a whitish powdery substance. Scale of the male smaller, elongate, and of the same general color as that of the adult female.

RECOGNITION CHARACTERS. Adult female when mounted about 1 mm. long, $\frac{3}{4}$ mm. wide. General body outline broadly oval, margins of prosoma somewhat produced laterally. Pygidium relatively acute. Submarginal dorsal pygidial macroducts slightly smaller than average size, each with a sclerotized semi-lunate rim about the orifice, the ducts situated between 7th and 8th segments, and one located near position of seta marking 5th abdominal segment, each with a clavate knob-shaped scleroses. Dorsal intermediate pygidial macroducts near anal opening or enclosed within frame formed by perivulvar pores entirely lacking, a few present along margins and submarginally on prepygidial abdominal segments (see Figure 2). Microducts arranged as shown in figure. Median lobes well developed, not fused at base, outer margin sloping and usually twice notched. Second lobes smaller, narrow, inner margin straight, outer margin usually twice notched, third lobes not indicated. Pygidial plates much reduced, tapering apically, not fimbriate, present only between the second lobes and seta marking position of sixth abdominal segment. Anal opening quite small, laterally oval, and situated less than one-fourth length of pygidium from pygidial fringe or apex. Vulva located about mid-pygidium. Perivulvar pores in four distinct groups, with from 1 to 4 pores per group. Prosoma membranous throughout. Ventral duct tubercles rounded-conical with the prespiracular, anterior spiracular, intermediate spiracular, posterior spiracular and first abdominal with from 1 to 4 ducts each. Eyespot developed as a minute protuberance situated opposite anterior spiracles. Anterior spiracle accompanied by 1 or 2 multilocular disk pores.

NOTES. This species is very closely related to *Parlatoareopsis chinensis* (Marlatt), but differs from it in the total absence of small dorsal intermediate pygidial macroducts near anal opening or enclosed within frame formed by the perivulvar pores. In addition the anal opening is much smaller than in typical *chinensis* and is situated less than one-fourth length of pygidium from pygidial apex. It differs from *Parlatoareopsis pyri* (Marlatt) chiefly in the presence of only a few submarginal dorsal macroducts on the pygidium and on the prepygidial abdominal segments.

This species was described from 25 specimens mounted on 20 microscope slides. The type specimen of this species will be deposited in the United States National Museum, Washington, D. C., and paratypes in the State Department of Agriculture collection at Sacramento, California, and in the author's own collection.

Parlagena buxi (Takahashi)

- 1935-36. *Gymnaspid buxi* Takahashi. Some Coccidae from China. Peking Natural History Bulletin, Volume 10, Part 3, Page 220, Figure 2.
1945. *Parlagena inops* McKenzie. A Revision of *Parlatoria* and Closely Allied Genera (Homoptera; Coccoidea; Diaspididae). Microentomology, Volume 10, Part 2, Pages 47-121, Illustrated.

During June 1948 Professor G. F. Ferris of Stanford University, California while working on a list of scale insects of China as a guide for his collecting in that country, came across an illustration of *Gymnaspid buxi* Takahashi. Professor Ferris noted that this species was identical to the author's *Parlagena inops*. Since *buxi* is very definitely not a *Gymnaspid*, my genus *Parlagena* will be here considered as valid, but my species, *inops*, will fall as a synonym of *buxi*.

This information was communicated to my friend and colleague Dr. A. Balachowsky, Chief of the Laboratory of the Pasteur Institute in Paris, who was preparing a description of a new species of *Parlagena* (*P. mckenzei*) from Beluchistan. Dr. Balachowsky makes note of the synonymy of *Parlagena inops* in a publication by him entitled "On a new *Parlagena* (Homoptera-Coccoidea) from Iranien Beluchistan", published in *Revue de Pathologie et d'Entomologie Agricole de France*, Volume 29, Number 1-2, January-June 1950.

REVISED KEY TO SPECIES OF *PARLATORIA*

In the author's 1945 "Revision of *Parlatoria* and Allied Genera" a key to *Parlatoria* species was presented. Since this revision several new species have been described, and due to certain other adjustments which appear necessary, it seems advisable at this time to formulate a revised key to this group. There still remain 12 species (two of which are doubtfully retained in the genus) which have not been available for study. These are: *alba* Bellio, *atalantiae* Green, *cinnamomi* Rutherford, *destructor* Newstead, *hastata* Lindinger, *itabicola* Kuwana, *judaica* Bodenheimer, *namunakuli* Green, *phyllanthi* Green, *rutherfordi* Green, *stigmadisculosa* Bellio, and *zeylanica* Rutherford. Of these, two, *judaica* and *rutherfordi*, are omitted from the key because of the inadequacy of the original descriptions, the others have been included on the basis of their original descriptions. While it is believed that these species are recognizable from their descriptions, it has seemed advisable to place a distinctive mark (†) after their names in order to indicate at least some degree of uncertainty concerning their characters.

The key has been formulated to facilitate identification and does not show relationships among the species.

In order to insure correct identifications it is important that well-stained preparations which emphasize the dermal characters of the prosoma, as well as those of the pygidium, be used.

- | | | |
|-------|---|---------------------------------|
| 1 | With only two pairs of pygidial lobes present..... | 2 |
| | With at least three pairs of pygidial lobes present..... | 3 |
| 2 (1) | Perivulvar pores in five groups..... | <i>alba</i> Bellio † |
| | Perivulvar pores in four groups..... | <i>destructor</i> Newstead † |
| 3 (1) | Perivulvar pores present..... | 4 |
| | Perivulvar pores lacking (probably immature)..... | <i>zeylanica</i> Rutherford † |
| 4 (3) | Anterior spiracles possessing from 10-15 adjacent multilocular disk pores each..... | 5 |
| | Anterior spiracles with 9 or less adjacent multilocular disk pores each..... | 8 |
| 5 (4) | Fourth pygidial lobes (fifth abdominal segment) definitely present, not closely resembling adjacent plates..... | 6 |
| | Fourth pygidial lobes lacking, being apparently replaced by a broad fimbriate plate..... | <i>stigmadisculosa</i> Bellio † |
| 6 (5) | Pygidium normally with four plates between third lobes (sixth abdominal segment) and position of the fourth lobe (fifth abdominal segment)..... | 7 |
| | Pygidium with three plates between the third lobe and position of the fourth lobes..... | <i>cinerea</i> Hadden |
| 7 (6) | Anal opening relatively small and situated about $\frac{1}{2}$ distance from pygidial fringe; vulva located approximately mid-pygidium; perivulvar pores numbering from 40 to 100; submarginal dorsal pygidial macroducts ranging from 29 to 100 to a side..... | <i>oleae</i> (Colvée) |
| | Anal opening relatively large, situated about mid-pygidium; ventral vulva in similar position; perivulvar pores numerous—total number from 125 to 218; submarginal dorsal pygidial macroducts numerous, ranging from 124 to 151 to a side..... | <i>boycei</i> McKenzie n.sp. |

- 8 (4) Second pygidial lobes larger than median, both pairs triangular and laterally serrate, not deeply notched.....*hastata* Lindinger †
 Second pygidial lobes at least not larger than median, both pairs never triangular, usually from 1 to 3 subapical notches on lateral margins, seldom laterally serrate (except in *P. yunnanensis* Ferris)..... 9
- 9 (8) Marginal dorsal pygidial macroducts extremely large.....*itabicola* Kuwana †
 Marginal dorsal pygidial macroducts of average size (see accompanying figure of a typical species)..... 10
- 10 (9) With a marginal tubular pygidial macroduct present between median lobes 12
 Without a marginal tubular pygidial macroduct present between median lobes..... 11
- 11 (10) With median and intermediate dorsal pygidial macroducts present; ventral derm pocket present between posterior spiracle and body margin.....*banksiae* (Maskell)
 Without median and intermediate dorsal pygidial macroducts; ventral derm pocket between posterior spiracle and body margin lacking.....*machilicola* Takahashi
- 12 (10) With at least a few sclerotized duct tubercles present on anterior prosoma cephalad of abdominal segments..... 19
 Without sclerotized duct tubercles on anterior prosoma..... 13
- 13 (12) With a conspicuous, ear-like, membranous lobe on each side of prosoma approximately opposite anterior spiracles.....*zizyphus* (Lucas)
 Without ear-like lobes on anterior prosoma opposite anterior spiracles... 14
- 14 (13) With at least 2 or 3 duct tubercles present on first or second abdominal segments..... 15
 Without duct tubercles on first or second abdominal segments.....*Blanchardii* (Targioni-Tozzetti)
- 15 (14) With 2 or 3 ventral cicatrices on second abdominal segment near each lateral margin.....*aonidiformis* Green
 Without ventral cicatrices on second abdominal segment near each lateral margin..... 16
- 16 (15) With ventral derm granulations behind mouth parts; eyespot modified to form a conspicuous and enlarged disk; pygidium acute.....*machili* Takahashi
 Without ventral derm granulations behind mouth parts; pygidium broad 17
- 17 (16) With three plates between third and fourth pygidial lobes; perivulvar pores in four or five groups..... 18
 With a plate followed by two rounded projections between third and fourth lobes, similar projections occurring beyond unsclerotized fourth lobes to apparently the fourth abdominal segment; a few (presumably 2 or 3) anterior median perivulvar pores present on pygidium.....*cinnamomi* Rutherford †
- 18 (17) With from 9-14 dorsal marginal macroducts present on each side of body; fourth lobe sclerotized and apically serrate.....*marginalis* McKenzie
 With only 3 or 4 dorsal marginal macroducts present on each side of body; fourth lobes if present unsclerotized.....*atalantiae* Green †
- 19 (12) With at least 1 or 2 intermediate dorsal macroducts present on pygidium within frame formed by perivulvar pores..... 20
 Without dorsal intermediate macroducts present on pygidium within frame formed by perivulvar pores..... 24
- 20 (19) Pygidium normally with four plates between third lobe (sixth abdominal segment) and position of the fourth lobe (fifth abdominal segment)..... 23
 Pygidium with only three plates between the third lobe and position of the fourth lobe..... 21
- 21 (20) Without dorsal intermediate macroducts situated anterior to pygidium on fourth abdominal segment..... 22
 With dorsal intermediate macroducts situated anterior to pygidium on fourth abdominal segment.....*crypta* McKenzie
- 22 (21) With at least 3 or 4 dorsal intermediate macroducts on each side of anal opening; second and third lobes externally twice-notched.....*cinerea* Hadden
 With not more than 1 or 2 dorsal intermediate macroducts on each side of anal opening; second and third lobes externally once-notched.....*citri* McKenzie

- 23 (20) Anal opening relatively small and situated about $\frac{1}{4}$ distance from pygidial fringe; vulva located approximately mid-pygidium; perivulvar pores numbering from 40 to 100; submarginal dorsal pygidial macroducts ranging from 29 to 100 to a side *oleae* (Colvée)
 Anal opening relatively large, situated about mid-pygidium; ventral vulva in similar position; perivulvar pores numerous—total from 125 to 218; submarginal dorsal pygidial macroducts numerous, ranging from 124 to 151 to a side *boycei* McKenzie n.sp.
- 24 (19) With a small, but distinct, invaginated membranous derm pocket between posterior spiracle and body margin 25
 Without an invaginated membranous derm pocket between posterior spiracle and body margin 29
- 25 (24) Eyespot modified to form a stout spur, projecting from prosoma about opposite mouthparts 26
 Eyespot various, flat, irregular, sometimes almost hemispherical and often so obscure as to appear lacking 27
- 26 (25) Fourth pygidial lobe slender, definitely sclerotized and almost spurlike *crotonis* Douglas
 Fourth pygidial lobe membranous and closely simulating adjacent plates in structure and appearance, although usually much smaller *proteus* (Curtis)
- 27 (25) Fourth pygidial lobe developed as a sclerotized projection of margin; perivulvar pores in 4 distinct groups 28
 Fourth pygidial lobe almost identical in appearance with adjacent plates; anterior and posterior groups of perivulvar pores apparently fused together *fulleri* Morrison
- 28 (27) Submarginal dorsal pygidial macroducts ranging in number from 20 to 29 on each side of body; pygidial lobes almost equal in size; perivulvar pores few in number, total range 19 to 33 with an average of about 26 *camelliae* Comstock
 Submarginal dorsal pygidial macroducts ranging in number from 26 to 95 (average about 51) on each side of body; pygidial lobes obviously graded, third pair definitely smaller than median pair; perivulvar pores numerous, total range 25 to 84 with an average of 58 *theae* Cockerell
- 29 (24) Pygidium normally with four pygidial plates between third lobe (sixth abdominal segment) and position of the fourth lobe (fifth abdominal segment) 30
 Pygidium with three pygidial plates between the third lobe and position of the fourth lobe 31
- 30 (29) Pygidial plates for the greater part tapering apically to a point; perivulvar pores numbering more than 100 *multiplora* McKenzie
 Pygidial plates for the greater part apically fimbriate; perivulvar pores numbering usually less than 100 *oleae* (Colvée)
- 31 (29) With dorsal intermediate macroducts present above anterior group of perivulvar pores and on abdominal segment anterior to these 32
 Without dorsal intermediate macroducts above anterior group of perivulvar pores and on abdominal segment anterior to these 33
- 32 (31) Second and third lobes laterally serrate, fourth lobe sclerotized *yunnanensis* Ferris
 Second and third lobes once-notched on either side, fourth lobe unsclerotized and closely resembling adjacent plates *pittospori* Maskell
- 33 (31) Dorsal marginal macroducts beyond third lobes with orifices perpendicular to pygidial margin; median, second and third pygidial lobes "hatchet-shaped" 34
 Dorsal marginal macroducts beyond third pygidial lobes with orifices parallel to pygidial margin; median, second and third pygidial lobes not "hatchet-shaped" (except in *mytilaspiformis*) 35
- 34 (33) Fourth pygidial lobe broadly rounded with margin dentate *cingala* Green
 Fourth pygidial lobe small and pointed *namunakuli* Green †
- 35 (33) Fourth pygidial lobe (fifth abdominal segment) at least somewhat developed and definitely sclerotized 36
 Fourth pygidial lobe unsclerotized and practically identical in appearance with adjacent plates *ephedrae* Lindinger

- 36 (35) Median ventral derm granulations present on prosoma and first abdominal segment at full maturity; anterior prosoma sclerotized.....*artocarp* Green
 Median ventral derm granulations on prosoma and first abdominal segment lacking at full maturity; anterior prosoma membranous..... 37
- 37 (36) Pygidial plates between third (sixth abdominal segment) and sclerotized fourth lobes (fifth abdominal segment) abruptly tapering apically, but little fimbriate*fluggeae* Hall
 Pygidial plates between third and sclerotized fourth lobes generally broad throughout and apically fimbriate..... 38
- 38 (37) Anterior groups of perivulvar pores with 9-12 pores each; pygidial lobes with outer margins normally 2 or 3 times notched.....*virescens* Maskell
 Anterior groups of perivulvar pores with 5-8 pores each; pygidial lobes only once-notched on outer margins..... 39
- 39 (38) Second and third pygidial lobes appearing somewhat "hatchet-shaped," that is, diagonally rounded apically; eyespot present on prosoma approximately opposite anterior spiracles.....*mytilaspiformis* Green
 Second and third pygidial lobes not "hatchet-shaped" or diagonally rounded apically; eyespot on prosoma lacking..... 40
- 40 (39) Fourth pygidial lobe about one-half size of either median or second lobes, represented by a short, sclerotized, conical projection, dentate on inner and outer margins, and usually with one prominent tooth produced apically*pergandii* Comstock
 Fourth lobe about one-fourth size of other lobes.....*phyllanthi* Green †

LEGEND FOR FIGURES

A, pygidium of the adult female; B, details of the dorsal aspect of the pygidial margin; C, habit; D, body of adult female. Unlettered details are connected to their points of origin by guide lines and should be readily identifiable.

The illustrations were prepared by the author.

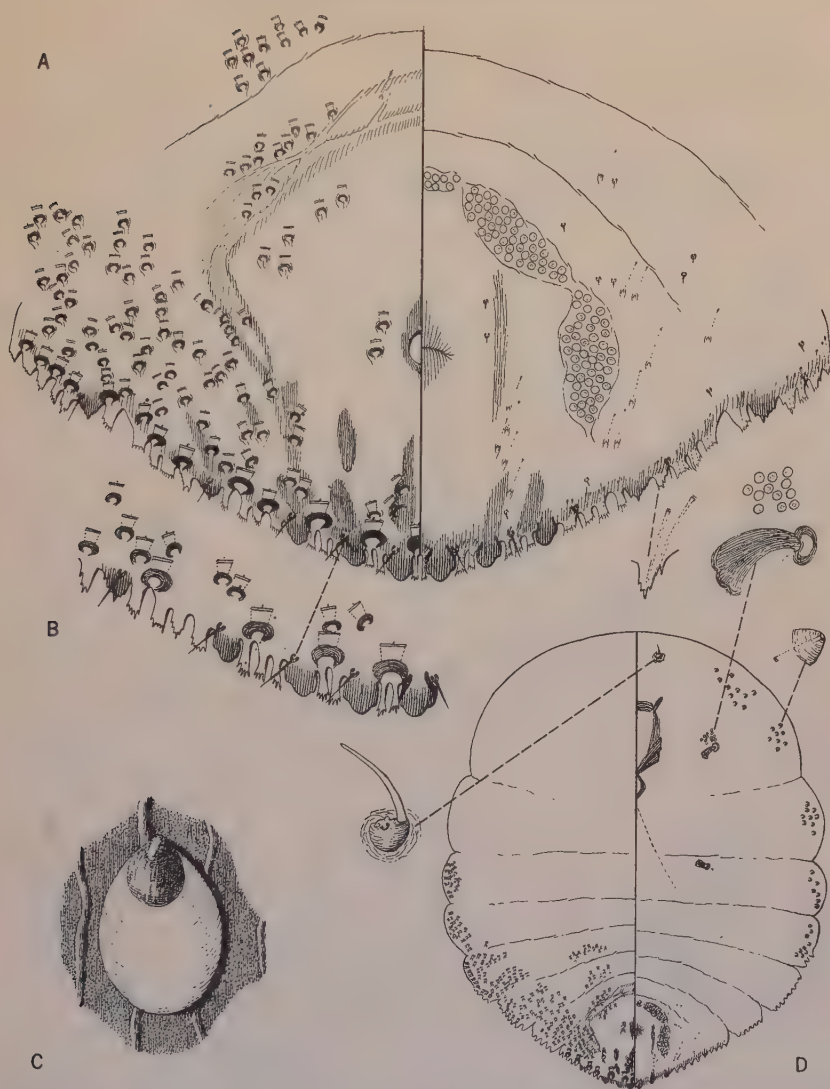


FIGURE 1. *Parlatoria boycei* McKenzie, new species. Collected on pear at Darjeeling, West Bengal, India, April 26, 1951, by Dr. A. M. Boyce and Mr. Norman Waters. This species is very closely related to *Parlatoria oleae* (Colvee), but differs in the position of the anal opening and vulva, and the more numerous perivulvar pores and dorsal submarginal pygidial macroducts.

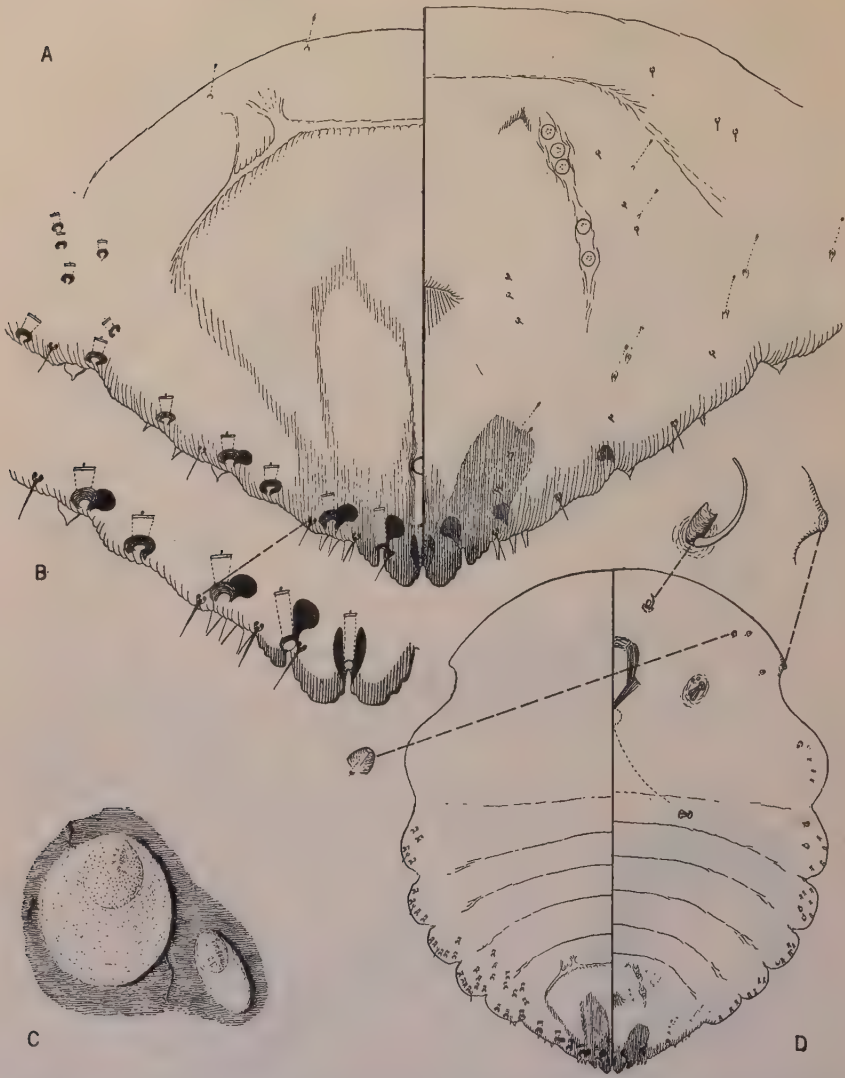


FIGURE 2. *Parlatoriopsis perplexus* McKenzie, new species. Collected on oleander, Cairo, Egypt, September 20, 1951, by Dr. A. M. Boyce. This species is strikingly similar to *Parlatoriopsis chinensis* (Marlatt), but differs in lacking small dorsal intermediate pygidial macroducts which are evident in the former species.

APRICOT POWDERY MILDEW FROM ROSE AND PEACH

C. E. YARWOOD¹

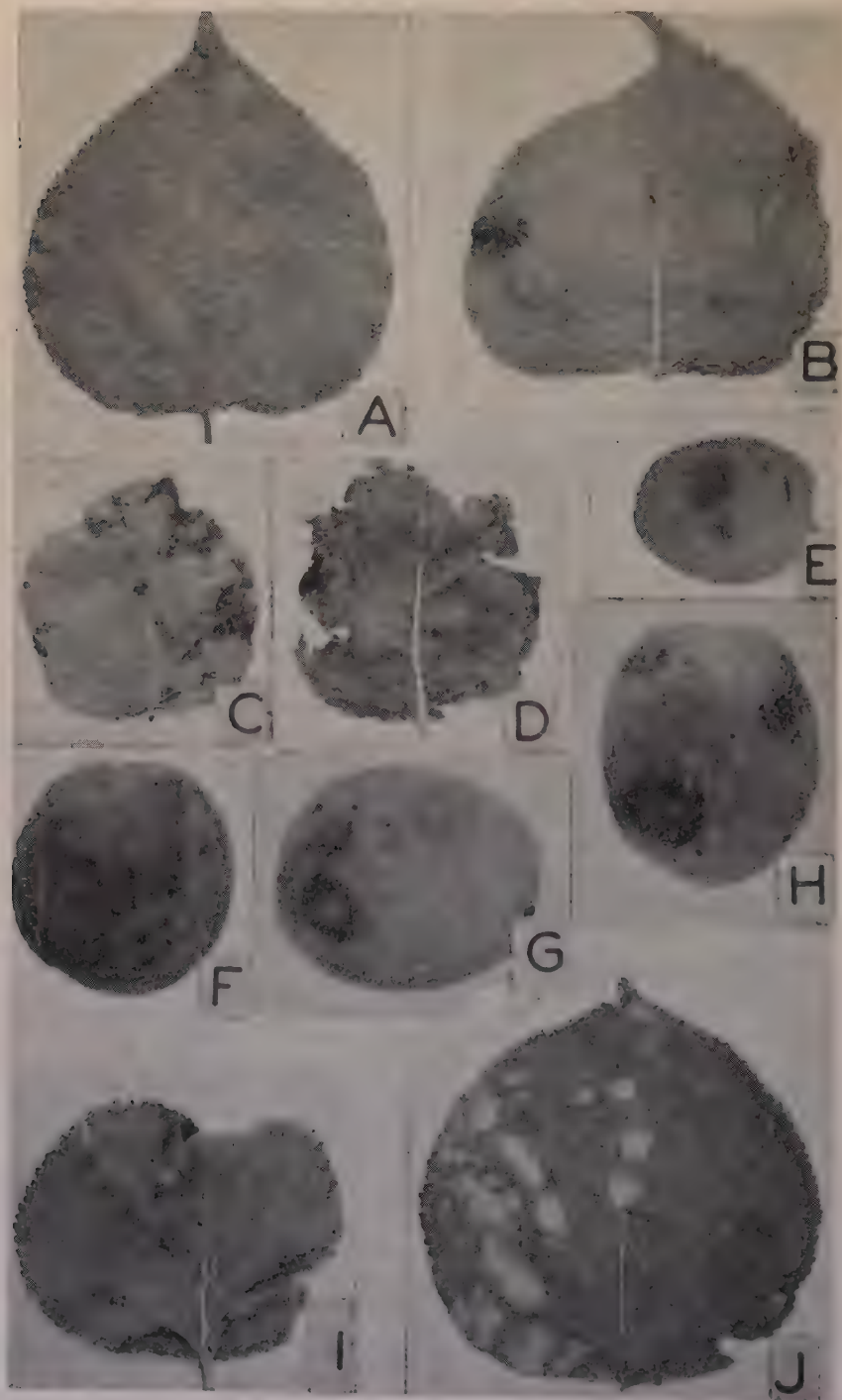
Division of Plant Pathology, University of California, Berkeley, California

Powdery mildew is a minor disease of apricots in California but localized heavy infections have reduced the quality of the fruit or caused the leaves to drop prematurely. The disease appears to comprise at least two distinct infections (Fig. 1): (1) fruit and leaf infection caused by conidia of *Sphaerotheca pannosa* Lev. produced on rose or peach, and (2) leaf infection caused by *Podosphaera tridactyla* (Wallr) De By which multiplies principally or exclusively on apricot leaves. These two infections will be discussed in more detail in this order and the first will be subdivided into possibly three subtypes.

Fruit infection first appears in early to late April as white powdery areas with abundant conidia, or more commonly as superficial necrotic areas with little sporulation (Fig. 1, E-H). As fruit increases in size conidiophores and mycelium may decrease or disappear and necrosis may increase. This is apparently a manifestation of increasing resistance to the disease with increasing age of fruit. There are few if any new infections after April. Infected fruit is commonly described by growers and packers as dirty because of the large or small necrotic areas, but dirtiness as the term is used by growers may also result from other causes. Heavily mildewed fruit is likely to be rejected for canning purposes if necrosis is pronounced, but infected fruit is regularly used for drying and few if any infected fruits are a total loss.

The fruit infection phase is commonly considered to be caused by *Sphaerotheca pannosa* (2, 3, 10, 12) which is believed to be the same morphologic species of powdery mildew that attacks roses and peaches. Such a diagnosis is uncertain because perithecia of powdery mildew have never been seen by the writer on peach fruit or leaves, or on apricot fruit. Only once have perithecia of this species been collected by the writer on rose and even here it could not be certain that the perithecia were of the same species as that which commonly produces the conidial infections on the same host. The conidial stage of powdery mildews on apricot fruit and leaves, on rose leaves, on peach leaves, and on some collections of peach fruit have been grossly similar. Though the conidia from rose leaves were slightly larger than those from peach leaves, and though conidia and conidiophores from apricot were more elongated than those from rose, the significance of these differences is uncertain. Foex (7) has distinguished the conidiophores of *Sphaerotheca pannosa* on rose from the conidiophores of *Podosphaera oxycanthae* var *tridactyla* on apricot, but this reviewer cannot be certain this distinction is valid. One collection of

¹ Assistance from H. E. Thomas, V. Duran, R. D. McCallum, M. R. Bell, and Juanita Hosking, of the University of California, from P. R. Miller of the U. S. Department of Agriculture, and from E. S. Castle of Mountain View, is hereby acknowledged.



mildew from peach fruit in 1935 was distinctly different from all other collections from peach, rose, or apricot, in that the conidia from this 1935 collection on peach were much larger and had projecting ridges at the region of detachment. The writer believes this 1935 collection belongs to a different morphologic species from all other collections on these hosts, but since no perithecia were found, and since powdery mildews cannot be adequately diagnosed on the basis of their imperfect stages, none of the conidial stages referred to in this report can be positively named.

On May 28, 1947, the writer first observed an apparent relation of powdery mildew on apricot fruit to powdery mildew on *Rosa Banksiae* in Mountain View. Apricot fruits on trees near to and in the direction of the prevailing wind from a large and heavily mildewed climbing *R. Banksiae* were heavily mildewed while more distant apricots in the same direction and apricots as near but in the opposite direction were much less affected. The grower reported that this condition had prevailed for several years previously. The *R. Banksiae* vine was removed in 1948 and the grower stated that he had no dirty apricots in the above location in 1949 and 1950. When the writer saw the location for the second time in May, 1951, no powdery mildew was found on apricot fruit or leaves.

In 1951 powdery mildew of apricot fruits was found at 10 locations in Contra Costa, Santa Clara, and San Benito Counties. Only four of these were of such importance that the writer is aware that the grower had sought to control the disease. In all 10 locations mildewed roses were found near and to the windward of the infected apricots and in 8 of the 10 locations the dominant or only rose in the immediate vicinity was a medium to large climbing *Rosa Banksiae*. In all cases where apricot trees continued for some distance to the leeward of the suspect *R. Banksiae*, the apricot disease decreased as the distance from the rose increased (Fig. 2). In one case in Hollister 3 percent of apricot fruits at a distance of one-half mile from the suspect *R. Banksiae* showed infection, but usually mildew could not be detected at this distance.

In seven of the eight cases where fruit infection was associated with *R. Banksiae*, the type of infection on apricot was the same. The lesions were superficial, fimbriate, and necrotic with little sporulation (Fig. 1, E-H). In one case in Brentwood, however, the lesions were principally non-necrotic and conidia were produced abundantly. In the Brentwood situation the infection was barely apparent on the ripe fruit. In one location in Hollister severe fruit cracking (Fig. 1, F) seemed to result from fruit infection, but fruit cracking from other causes has been fairly common on young trees.

Secondary spread from apricot to apricot fruit was of little importance if it did occur at all, for there was no clear increase in the amount of distribution of the disease on the fruit after the end of April.

FIGURE 1. Apricot powdery mildew. A to F, infection by *Sphaerotheca pannosa*. A to D, leaf infection from conidia produced on *Rosa Banksiae*. A, infection which occurred on almost mature leaf. Lesions are very small and principally on the left side. B and C, large lesions showing the radiating and necrotic nature of the infections. D, old leaf heavily infected when young, showing the tearing of the leaf edges. E and F, early and late stages of fruit infection resulting from conidia produced on *Rosa Banksiae*. F shows cracking. G and H, fruit infection photographed in 1933, without known association with rose mildew. G shows some white conidia on the lesion. I, leaf infection resulting from conidia produced on peach. Some of the lesions show conidia. J, leaf infection by *Podosphaera tridactyla* showing large and small white mildew colonies with an abundance of conidia but no necrosis or leaf distortion. This is the widespread form of apricot powdery mildew in California.

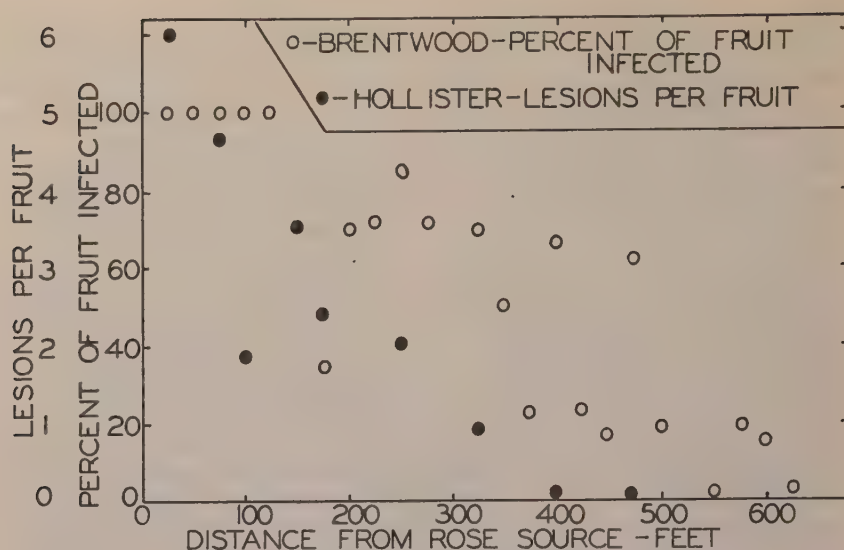


FIGURE 2. Relation of distance from *Rosa Banksiae* to infection of apricot fruits with powdery mildew. At 500 to 600 feet the infection was only about one-tenth of that which occurred at 0 to 50 feet from the infected roses.

Two cases of powdery mildew on apricot fruit were observed where *R. Banksiae* could not be invoked as the source of the inoculum. At one of these, a large number of miscellaneous mildew-infected bush and climbing roses, not including *R. Banksiae*, were across the street and to the windward of an isolated apricot tree in Concord where most of the fruits showed mildew lesions similar to those formed where *R. Banksiae* was apparently the source of inoculum. At the other of the two locations, mildewed Dorothy Perkins roses were climbing on a fence bounding an apricot orchard near Hollister. Here small mildew lesions were abundant on apricot fruits and leaves near the Dorothy Perkins roses but decreased rapidly as the distance between the apricots and roses increased. Whereas single mildew lesions on apricot were a maximum of 12 mm. in diameter where infection was associated with *R. Banksiae*, the lesions were a maximum of only 0.7 mm. where Dorothy Perkins was the apparent source of the inoculum.

In 7 of the 10 locations where apricot fruits were infected with mildew, the leaves were also infected, though in smaller numbers than the fruits when first observed. While fruit infection apparently did not increase after the last of April, new leaf infections continued to appear on the unfolding young leaves. This leaf infection remained localized near the suspect roses, and therefore was apparently not spreading from apricot to apricot. In the latter part of July, leaf infection was more abundant than fruit infection. No infection was detected on fully expanded leaves, and leaves infected when young did not grow to normal size. Leaves which were heavily infected early in the season became distorted and torn at the edges as though the internal tendency for growth was prevented by the necrotic epidermal cells (Fig. 1, D).

In two locations apricot leaves showed infection similar to that found in association with *Rosa Banksiae* but no roses were present, and the infection was clearly traceable to mildewed peaches. In an experimental plot in Berkeley, a single heavily mildewed Palora peach tree grew adjacent to and north of the sixth apricot tree in a row of 12 apricot trees running east and west. Prevailing winds were from the west-southwest but there were undoubtedly many shifts in wind direction. In 1949, 1950, and 1951 apricot leaves near the mildewed peach were heavily mildewed and the disease decreased at progressive distances from the peach. The other location where apricot leaf infection apparently resulted from inoculum produced on peach was near San Jose. In both the Berkeley and San Jose situations no infected fruits were found. This could easily be because the inoculum on peach did not develop in abundance until the apricot fruits had passed through the susceptible stage.

Several *R. Banksiae* vines in addition to those apparently associated with apricot mildew, were found in this study, and most were infected with mildew, but no apricot trees were near enough to reveal the possible transfer of rose mildew to apricot. In one case in Irvington, a heavily mildewed *R. Banksiae* was found about 150 feet to the windward of a single poorly growing apricot tree with few fruit, but no mildew could be found on the leaves or fruit.

Also, cases of miscellaneous mildewed roses adjacent to apricots without mildew appearing on the apricots have been seen. The distinctive menace of *Rosa Banksiae* in contrast to other rose varieties may result partly from the large size of the *R. Banksiae* vines, which the writer estimates may reach several hundred pounds in weight in some cases.

The observations reported in this paper indicate there may be four strains of *Sphaerotheca pannosa* as follows:

1. A strain such as that which was abundant on *R. Banksiae* in 1951, which gave large lesions on Blenheim apricot fruits and leaves. (Fig. 1, A to F.)
2. A strain such as that occurring in Hollister in 1951 on Dorothy Perkins roses which gives small lesions on Blenheim apricots.
3. A strain which does not infect apricot.
4. A strain attacking peach and apricot. (Fig. 1, I.)

It is quite possible that the strain on peach is the same as 1, but in 1939 the prevailing mildew on peach in Berkeley was different from the prevailing mildew on rose.⁽¹³⁾

To further test the idea that mildew infection of apricot fruit was from inoculum produced on rose, Blenheim apricot fruits in the field at Hollister, in the field at Berkeley, and as detached fruits in the laboratory in Berkeley were inoculated on April 25, 1951 with powdery mildew from *R. Banksiae* from Hollister. Infection occurred under each condition and a total of 21 fruits were infected out of a total of 51 inoculated. The infection appeared similar to that which occurred naturally. Infection was principally of the necrotic type but some spores were produced. None of 38 control fruits were infected. Apricot fruits were also inoculated with mildew from an unidentified variety of bush rose growing near one of the *R. Banksiae* vines at Hollister. Of 28 fruits inoculated with the mildew from the unidentified rose, 15 became infected, but sporulation appeared less than with inoculum from *R. Banksiae*.

The typical mildew infection of apricot leaves is entirely different from the necrotic type which occurs in association with the fruit infection as above described. Typical leaf infection is most conspicuous on the upper surface of mature leaves as white radiating colonies with an abundance of conidia and with little necrosis. In the early phases of the disease it is characteristic to find leaves with a few large colonies, and with many small colonies nearby (Fig. 1, J). The small colonies likely developed from conidia produced in the earlier larger colonies. Typical leaf infection has been first found in orchards in July, though similar infection in greenhouses and lathhouses has been seen earlier. Near Hayward, in Alameda County, where the disease has been most frequently observed, usually only a few isolated infections are found in July, but by October all orchards examined were infected, and in some the upper surfaces of the inner leaves were covered with mycelium and perithecia and leaf fall due to infection was beginning. The disease caused practically no distortion of the leaves.

Perithecia of this powdery mildew from apricot leaves have been diagnosed as those of *Podosphaera leucotricha*, (6) *P. oxyacanthae*, (1,4,8,9, 12) *P. oxyacanthae* var *tridactyla*, (5,7,11) and as *P. tridactyla* (3). The writer accepts *P. tridactyla* as described by Blumer (3) as the cause of the typical leaf infection of apricot in California.

No evidence of strains of *P. tridactyla* on apricot has been observed.

There was no apparent correlation in the distribution of the typical fruit and typical leaf phases of apricot mildew. On July 31, 1951, apricots in 19 locations in Alameda, Santa Clara, San Benito, and Contra Costa Counties were examined for mildew. Typical leaf infection was found in nine of the coolest locations including western Alameda and western San Benito Counties, but was not found in eastern San Benito County or in Contra Costa County. No typical leaf infection was found in five of the locations where fruit infection was found in April and May, and where the necrotic leaf infection could still be seen.

SUMMARY AND CONCLUSIONS

All cases of infection of apricot fruit with powdery mildew (*Sphaerotheca pannosa*) seen during the past five years have been associated with mildewed roses, and most of these with the powdery mildew growing on *Rosa Banksiae*. The disease decreased as the distance between the roses and apricots increased, and did not appear to spread from apricot to apricot.

Infection of apricot leaves with mildew was of four apparent types.

1. Large necrotic lesions resulting from infection by *S. pannosa* from *R. Banksiae*.
2. Large necrotic lesions resulting from infection by *S. pannosa* from peach.
3. Small necrotic lesions resulting from infection by *S. pannosa* from Dorothy Perkins rose.
4. Large non-necrotic infections of *Podosphaera tridactyla* which overwinters as perithecia and which develops only on apricot.

Only the latter infection has been widespread in California.

Literature Cited

- ⁽¹⁾ Archer, W. A. Plant diseases in Iowa in 1927. U. S. Dept. Agr. Plant Dis. Repr. Suppl. 58: 1-64. 1928.
- ⁽²⁾ Baudys, E. Cesky Odbor Zemedelske Rady Moravske, Brnó. Leaflet 32. 2 pp. [Mildews of fruit trees and shrubs.] (Abstr. in Rev. Appl. Myc. 10: 247-248. 1931.)
- ⁽³⁾ Blumer, S. Die Erysiphaceen mitteleuropas. 483 pp. Gebr. Fretz A. G. Zurich. 1933.
- ⁽⁴⁾ Chabrolin, C. Quelques maladies des plantes cultivées en Tunisie. Bull. Direct. Gen. de l'Agric., Comm. et Colonis. [Tunis] 21 pp. 1927. (Abstr. in Rev. Appl. Mycol. 6: 597-598. (1927.))
- ⁽⁵⁾ Cristinzio, M. Malattie delle piante da frutto nella Campania e nel mezzogiorno. [Diseases of fruit trees in Campania and southern Italy.] R. Lab. Pat. Veg., Portici 3: 47-87. 1934. (Abstr. in Rev. Appl. Myc. 13: 706. 1934.)
- ⁽⁶⁾ Da Camara, E. de S., de Oliveira, A.L.B., and C. G. da Luz. Mycetes-aliquot Lusitaniae. I in Laboratorio Pathologiae Vegetalis Instituti Agronomici Olisipponis observata. Rev. Agron., Lisboa 24(2). 37 pp. 1936. [Some fungi of Portugal studied at the Phytopathological Laboratory of the Lisbon Agronomic Institute.] (Abstr. in Rev. Appl. Myc. 16: 563, 1936.)
- ⁽⁷⁾ Foex, Et. Notes sur quelques Erysiphacées. Bull. Trimestrial Soc. Myc. de France 41: 417-438. 1926.
- ⁽⁸⁾ Guyot, A. L. Les maladies des arbres fruitiers a noyau. 46 pp. Paris Librairie Agr. de la Maison Rustique, and Villefrance (Rhône), Librairie du Progress Agr. et Vit. 1929. (Abstr. in Rev. Appl. Myc. 8: 655. 1929.)
- ⁽⁹⁾ Marchal, P., and E. Foex. Rapport phytopathologique pour les années 1926-27. Ann. des Epiphyt. 13: 383-454. 1927.
- ⁽¹⁰⁾ Samuel, G. Summary of plant disease records in South Australia for the two years ending June 30, 1930. Jour. Dept. Agr. S. Australia 34: 746. 1931.
- ⁽¹¹⁾ Sarejanni, J. A. Notes phytopathologiques. Ann. Inst. Phytopath. Benaki, Greece 1(3): 67-76. 1935. (Abstr. in Rev. Appl. Myc. 15: 556. 1936)
- ⁽¹²⁾ Smith, Ralph E. Diseases of fruits and nuts. California Agr. Ext. Circ. 120. 168 pp. 1941.
- ⁽¹³⁾ Yarwood, C. E. Powdery mildews of peach and rose. Phytopath. 29: 282-284. 1939.

ATMOSPHERIC FUMIGATION OF VARIOUS SEEDS WITH METHYL BROMIDE

By EARLE T. GAMMON
Economic Entomologist

State Department of Agriculture, Sacramento

There have been many requests for information regarding the tolerance of various seeds to the vapors of methyl bromide. These have come from seedsmen, warehousemen, agricultural commissioners and members of other bureaus of the department.

The Bureau of Entomology had very little definite information in this regard, although some tests were made several years ago. One such test made by Mackie and Carter in 1937 showed that under a 27-inch vacuum, turnips, Kentucky wonder beans, carrots, lettuce and lima beans were tolerant to 2.5 pounds per 1,000 cubic feet for 90 minutes at 63 degrees F. This was not an ordinary schedule, and under many conditions it would be difficult, if not impossible to practice vacuum fumigation. Atmospheric fumigation requires a much longer cycle and so, while indicative, the results of the test were not entirely satisfactory to the trade.

In 1942, Mackie did some further work to determine if methyl bromide fumigation was responsible for reported lowered germination in red kidney beans, *Phaseolus vulgaris*. These seeds were fumigated with methyl bromide in refrigerator cars. Complete tolerance was shown up to 2.4 pounds per 1,000 cubic feet for 24 hours at a temperature of 54 degrees F.

At 2.8 pounds per 1,000 cubic feet for 24 hours at 52 degrees F., germination was retarded about 24 hours. A retest 12 days after fumigation showed that the germination was no longer retarded by that schedule.

The condition of the refrigerator cars was not noted, but as pointed out by Dr. O. F. Bodenstein, it is known that the best of the refrigerator cars lose 35 percent of the methyl bromide in two hours, with the average loss much higher. Temperatures were low also, so it is doubtful if even the heaviest of the schedules, 2.8 pounds per 1,000 cubic feet for 24 hours at 52 degrees F., equaled the customary schedule, in a tight room or under a gas tight tarpaulin, of 1 pound per 1,000 cubic feet for 24 hours at a temperature of 70 degrees F.

Over the years there has been considerable evidence to suggest that seeds with high moisture content are more susceptible to fumigation injury than are those with low moisture content. In neither of the above tests was the moisture content determined or considered, but presumably it was on the dry side, as the seeds employed in the vacuum series were ordinary packet seeds picked up on the retail market.

With this early work in mind, atmospheric methyl bromide fumigation tests were made on several kinds of seed with the assistance and cooperation of the Bureau of Rodent and Weed Control and Seed

Inspection in procuring seeds and running the germination tests, and the Bureau of Chemistry in making moisture content analyses.

In order to approximate the moisture content of seeds likely to be encountered in their fumigation, one-half of each lot of seed was held in a gas-tight room for approximately one week with a very high humidity maintained throughout the period. This humidity approached 100 percent at times, but occasionally fell to near 70 percent. At the time of fumigation the seeds were further divided, and small samples of those held at high humidity and those kept in normal storage given to the Bureau of Chemistry for tests of the moisture content. Moisture content of the seeds was raised from 1.10 percent for cabbage and beets to 5.75 percent for peas by the storage at high humidity.

Two fumigation schedules were used:

1 pound per 1,000 cubic feet for 24 hours at 78 degrees-92 degrees F., and 2 pounds per 1,000 cubic feet for 35 or 36 hours at 78 degrees-92 degrees F.

No attempt was made to control temperatures or humidity during fumigation. Humidity averaged about 52 percent.

A retest was made at the heavier schedule on the seeds of red kidney beans, peas and Sudan grass with the higher moisture content to recheck earlier results and to further test effects of fumigation on germination. Temperatures during fumigation ranged from 65 degrees F. to 80 degrees F., humidity 52 percent.

A summary of the seeds tested, schedules employed, and germination results follow:

<i>Seed variety</i>	<i>Moisture content (Percent)</i>	<i>Methyl bromide schedule</i>	<i>Germination</i>
Beets, Detroit Dark Red-----	8.24	1 lb. /M/24 hrs.	98.00
Beets, Detroit Dark Red-----	9.34	1 lb. /M/24 hrs.	93.50
Beets, Detroit Dark Red-----	8.24	2 lbs./M/35 hrs.	97.25
Beets, Detroit Dark Red-----	9.34	2 lbs./M/35 hrs.	94.50
Beets, Detroit Dark Red-----	8.24	Check	95.50
Beets, Detroit Dark Red-----	9.34	Check	98.25
Beans, Giant Stringless, Snap-----	7.04	1 lb. /M/24 hrs.	96.00
Beans, Giant Stringless, Snap-----	8.78	1 lb. /M/24 hrs.	85.00
Beans, Giant Stringless, Snap-----	7.04	2 lbs./M/35 hrs.	88.00
Beans, Giant Stringless, Snap-----	8.78	2 lbs./M/35 hrs.	71.00
Beans, Giant Stringless, Snap-----	7.04	Check	96.00
Beans, Giant Stringless, Snap-----	8.78	Check	95.00
Acala Cotton-----	6.00	1 lb. /M/24 hrs.	93.50
Acala Cotton-----	7.99	1 lb. /M/24 hrs.	91.00
Acala Cotton-----	6.00	2 lbs./M/35 hrs.	90.00
Acala Cotton-----	7.99	2 lbs./M/35 hrs.	86.50
Acala Cotton-----	6.00	Check	93.50
Acala Cotton-----	7.99	Check	92.50
Cabbage-----	5.66	1 lb. /M/24 hrs.	89.50
Cabbage-----	6.77	1 lb. /M/24 hrs.	84.25
Cabbage-----	5.66	2 lbs./M/35 hrs.	89.25
Cabbage-----	6.77	2 lbs./M/35 hrs.	89.00
Cabbage-----	5.66	Check	89.25
Cabbage-----	6.77	Check	91.00
Celery-----	7.33	1 lb. /M/24 hrs.	70.00
Celery-----	8.80	1 lb. /M/24 hrs.	69.25
Celery-----	7.33	2 lbs./M/35 hrs.	76.00
Celery-----	8.80	2 lbs./M/35 hrs.	71.50

<i>Seed variety</i>	<i>Moisture content (Percent)</i>	<i>Methyl bromide schedule</i>	<i>Germination</i>
Celery	7.33	Check	71.75
Celery	8.80	Check	65.00
Flax	5.00	1 lb. /M/24 hrs.	90.25
Flax	6.34	1 lb. /M/24 hrs.	86.50
Flax	5.00	2 lbs./M/35 hrs.	89.75
Flax	6.34	2 lbs./M/35 hrs.	88.00
Flax	5.00	Check	88.75
Flax	6.34	Check	88.50
Lettuce	5.32	1 lb. /M/24 hrs.	90.25
Lettuce	6.01	1 lb. /M/24 hrs.	89.25
Lettuce	5.32	2 lbs./M/35 hrs.	90.00
Lettuce	6.01	2 lbs./M/35 hrs.	85.50
Lettuce	5.32	Check	91.25
Lettuce	6.01	Check	93.00
Ventura Lima Bean	7.27	1 lb. /M/24 hrs.	88.00
Ventura Lima Bean	10.51	1 lb. /M/24 hrs.	96.00
Ventura Lima Bean	7.27	2 lbs./M/35 hrs.	90.00
Ventura Lima Bean	10.51	2 lbs./M/35 hrs.	70.00
Ventura Lima Bean	7.27	Check	90.00
Ventura Lima Bean	10.51	Check	92.00
Peas	6.82	1 lb. /M/24 hrs.	84.50
Peas	8.75	1 lb. /M/24 hrs.	69.50
Peas	6.82	2 lbs./M/35 hrs.	80.50
Peas	8.75	2 lbs./M/35 hrs.	57.50
Peas	6.82	Check	92.00
Peas	8.75	Check	85.00
Peas	7.12	2 lbs./M/36 hrs.	86.00
Peas	12.56	2 lbs./M/36 hrs.	76.00
Peas	7.12	Check	96.00
Peas	12.56	Check	94.00
Peas	12.56	2 lbs./M/36 hrs.	*75.00
Bean, Red Kidney	7.53	1 lb. /M/24 hrs.	92.50
Bean, Red Kidney	9.32	1 lb. /M/24 hrs.	95.00
Bean, Red Kidney	7.53	2 lbs./M/35 hrs.	98.00
Bean, Red Kidney	9.32	2 lbs./M/35 hrs.	84.50
Bean, Red Kidney	7.53	Check	91.00
Bean, Red Kidney	9.32	Check	94.50
Bean, Red Kidney	7.88	2 lbs./M/36 hrs.	95.00
Bean, Red Kidney	11.90	2 lbs./M/36 hrs.	55.50
Bean, Red Kidney	7.88	Check	98.00
Bean, Red Kidney	11.90	Check	98.00
Bean, Red Kidney	11.90	2 lbs./M/36 hrs.	*53.00
Sudan Grass	8.55	1 lb. /M/24 hrs.	92.25
Sudan Grass	10.14	1 lb. /M/24 hrs.	80.75
Sudan Grass	8.55	2 lbs./M/35 hrs.	81.75
Sudan Grass	10.14	2 lbs./M/35 hrs.	71.25
Sudan Grass	8.55	Check	93.00
Sudan Grass	10.14	Check	89.75
Sudan Grass	9.20	2 lbs./M/36 hrs.	86.00
Sudan Grass	11.98	2 lbs./M/36 hrs.	53.25
Sudan Grass	9.20	Check	93.00
Sudan Grass	11.98	Check	95.50
Sudan Grass	11.98	2 lbs./M/36 hrs.	*49.00

* Dried out and aerated for 27 days following fumigation.

It is apparent from the above summary that the germination of seeds of Detroit dark red beets, acala cotton, cabbage, celery and flax was not damaged by fumigation with methyl bromide at the schedules employed and at the moisture contents which existed during the experiment. It is true that these varieties did not readily pick up moisture and that the seeds with the highest moisture content averaged only 1 to 2 percent more moisture than the dry samples.

The germination of lettuce seed of low moisture content was not damaged at either fumigation schedule. Slight germination injury occurred when seeds containing 6.01 percent moisture were fumigated at the heavy schedule.

Germination of Ventura lima beans was undamaged except when seeds of high moisture content were fumigated at the heavy schedule. There should be no hazard in normal fumigation, 1 lb./M/24 hrs., under average moisture conditions.

Giant stringless beans with low moisture content showed no germination damage when fumigated at normal schedules, but slight damage occurred at the high fumigation schedule. Seeds with high moisture content were slightly intolerant to the normal fumigation schedule, and germination was definitely injured by fumigation at the high schedule.

Red kidney beans with 7.53 percent and 9.32 percent moisture showed complete tolerance to the normal fumigation schedules of 1 lb./M/24 hrs. Germination was injured by fumigation at the heavy schedule when the moisture content was 9.32 percent and severely damaged when the moisture content was 11.90 percent.

Sudan grass seed with low moisture content was undamaged by fumigation at the normal schedule. Germination was lowered when seeds with high moisture content were fumigated at the normal schedule, and at the heavy schedule germination was injured regardless of moisture content.

Peas with 6.82 percent moisture were tolerant to fumigation at the normal schedule and showed only slight damage to germination when fumigated at the high schedule. Definite damage to germination occurred when seeds with 8.75 percent or more moisture were fumigated at either schedule.

The germination of seeds of red kidney beans, Sudan grass, and peas with high moisture content was not improved by aeration and drying for 27 days after fumigation when germination of the seeds had been injured by fumigation at the heavy schedule.

General conclusions are that the germination of seeds tested will not be damaged by atmospheric fumigation with methyl bromide at dosages of 1 lb./M/24 hrs. at temperatures up to 90 degrees F., providing moisture content of the seed is low. If germination is retarded by fumigation, thorough aeration for two weeks should restore the germination to normal, but if the final germination percentage has been lowered it is impossible to increase that percentage. Fumigation of seeds with high moisture content at recommended dosages or at schedules heavier than at 1 lb./M/24 hrs. should be practiced with caution.

The interest and helpful suggestions of the work by W. D. Hay, Seed Technologist, U. S. D. A., Federal-State Seed Laboratory, Sacramento, California, are gratefully acknowledged.

ERIOPHYID STUDIES XVIII

H. H. KEIFER

California Department of Agriculture

The present article continues the survey of Eriophyid mites native to California. The last installment of this series, XVII, appeared in this Bulletin, Vol. 40, No. 3, p. 93, Sept. 26, 1951. This installment adds ten more new species and four new genera to our list. Three of the new species are representatives of the mite complex found in the attractive magenta-colored erineum on Sierra maple leaves. One new species is from Mountain mahogany, *Cercocarpus*. One mite is from white fir, another from madrone, and one from California juniper.

PHYTOPTINAE

Anchiphytoptus Keifer, new genus

Body wormlike. Rostrum of moderate size, downcurved. Shield subtriangular, not projecting over rostrum base; dorsal tubercles ahead of rear shield margin, directing the dorsal setae forward; a frontolateral seta on the margin of the shield above each forecoxa. Anterior coxae connate, coxal setae as usual. Forelegs with frontodorsal tibial seta and lateral terminal tibial spur; hindlegs with patellar seta lateral. Abdomen with a subdorsal seta on each side a short distance caudad of the shield; abdominal rings microtuberculate, these microtubercles forming a pattern of longitudinal lines on the dorsal half. Female genital coverflap smooth except for a basal design of curved lines.

Genotype; *Anchiphytoptus lineatus*, new species.

Anchiphytoptus lineatus Keifer, new species

Plate 210

Female 210 μ long, 45 μ thick, wormlike. Rostrum 30 μ long, downcurved. Shield 28 μ long, 35 μ wide, subtriangular; median line present on rear $\frac{3}{4}$, admedian lines complete, undulating; three lateral lines distinguishable, short; sides of shield set with tubercles in downward directed lines; dorsal tubercles 18 μ apart; dorsal setae 8 μ long, directed ahead and up; anterior shield setae 10 μ long. Forelegs 40 μ long, tibia 10 μ long bearing a seta and lateral spur, tarsus 9 μ long; claw 10 μ long, tapering and downcurved; featherclaw simple, 5-rayed. Hindleg 30 μ long, tibia 5 μ long, tarsus 8 μ long, claw 10 μ long. Coxae bearing a few tubercles. Abdomen with 65-70 rings; entirely microtuberculate, the dorsal half with lines of microtubercles. Subdorsal setae on about ring 9, 20 μ long; lateral seta on about ring 7, 20 μ long; first ventral seta 20 μ long, on about ring 20; second ventral 9 μ long, on about ring 38; third ventral 25 μ long, on about ring 5 from rear; accessory seta present. Female genitalia 20 μ wide, 18 μ long, coverflap with no scoring but basal curved lines forming a lobular design; seta 12 μ long. Male 150 μ long, 45 μ thick.

Type locality: Rocky Camp, Hat Creek, Shasta County, California.

Collected: August 10, 1948, by the writer. **Host:** *Cercocarpus ledifolius* Nuttall, Mountain mahogany (Rosaceae). **Relation to host:** These peculiar mites appeared during the recovery process for a leaf vagrant mite. They are presumably bud mites. **Type slide:** So designated and with the above data. Paratype slides: five in number as above. The genus is based on the striking dorsal lines shown by the mite, otherwise it is the same as *Phytoptus*. The name means "Another *Phytoptus*."

Trisetacus Keifer, new genus

Body elongate, wormlike. Rostrum of moderate size, downcurved. Shield broad, approximately semicircular, not projecting over rostrum base; dorsal tubercles ahead of rear shield margin, directing setae forward; a central frontal shield seta above rostrum base. Forelegs with all usual setae and a tibial spur; hindlegs with patellar seta normally placed. Abdomen with rings completely microtuberculate; a pair of anterior subdorsal setae. Female genital coverflap smooth; seminal vesicles on long stalks.

Genotype: *Phytoptus pini* Nal.

The only other California species so far on record that will go into this new genus is *cupressi* K. The status of *quadrisetus* Thom. remains to be investigated in this connection. The new genus differs from *Phytoptus* (type: *avellanae* Nal.) by the possession of three instead of four shield setae, by the normally placed hind patellar seta, and by the internal genital structures. The name is a contraction of *Acarus* plus a designation for the three setae on the shield.

ERIOPHYINAE**Pareria** Keifer, new genus

Body elongate, wormlike, curved caudally. Rostrum of moderate size, downcurved. Shield broad, subtriangular, not projecting over rostrum base; dorsal tubercles near rear shield margin, but pointing forward, and projecting the dorsal setae up and forward. Legs with all usual setae. Abdomen with rings completely microtuberculate; anterior $\frac{3}{4}$ of abdomen with dorsal and ventral sides evenly ringed; last quarter of abdomen divided into broader tergites, and sternites remaining of usual size, the tergites covering two sternites and with elongate microtubercles. Female genital coverflap longitudinally scored.

Genotype: *Pareria fremontiae* n. sp.

Pareria fremontiae Keifer, new species

Plate 211

Female 150 μ long, 30 μ thick, wormlike, caudally downcurved, color yellowish to brownish. Rostrum 21 μ long, projecting downward. Shield subtriangular, 21 μ long, 23 μ wide, central design of longitudinal lines, the median line continuous on rear half, the admedian lines set close to the median line and not diverging greatly toward rear; three submedian lines also closely spaced; shield laterally with lines of granules; dorsal tubercles 12 μ apart, near rear margin; dorsal setae 15 μ long, projecting ahead and up. Forelegs 22 μ long, tibia 5 μ long, tarsus 5 μ long, claw 9 μ long, featherclaw five-rayed. Hindlegs 20 μ long, tibia 4 μ long, tarsus 5 μ long, claw 10 μ long. Abdomen with about 60 tergites and 65-70 sternites; the broader tergites beginning about 15 rings from the rear; rings completely microtuberculate. Lateral seta 16 μ long, on about sternite 8; first ventral 23 μ long, on about sternite 21, second ventral 16 μ long, on about sternite 40; third ventral 15 μ long, on about sternite 5 from rear; accessory seta present. Female genitalia 18 μ wide, 15 μ long, coverflap with about 14 longitudinal furrows, seta 5 μ long.

Male 140 μ long, 25 μ thick.

Type locality: Phelan district, San Bernardino County, California. **Collected:** September 30, 1951, by the writer. **Host:** *Fremontia californica* Torr. Flannel bush (Sterculiaceae). **Relation to host:** The mites live in and around the heavy stellate pubescence on the green twigs and on the underside of the leaves. **Type slide:** So designated, with the above data. Paratype slides: six in number as above. This mite would fit into *Paraphytoptus* but the direction of the shield setae makes the erection of a new genus necessary. The name of the genus is *Para* plus a contraction of *Eriophyes*, since the species has the shield seta type of Eriophyes.

***Aceria calaceris* Keifer, new species**

Plate 212

Female 180-190 μ long, 55 μ thick, yellow, wormlike. Rostrum 19 μ long, projecting diagonally down. Shield 25 μ long, 38 μ wide, subtriangular, nearly smooth, some lateral lines. Dorsal tubercles 18 μ apart, on rear margin; setae 24 μ long, projecting backward. Forelegs 30 μ long, tibia 4 μ long, with a minute seta on inner proximal side of front; tarsus 8 μ long, featherclaw 4-rayed. Hindleg 23 μ long, tibia 4 μ long, tarsus 6 μ long, claw 8 μ long. Forecoxae connate. Abdomen with more tergites than sternites: about 85 tergites and 65 sternites. Microtubercles only on the sternites, the tergites smooth. Lateral seta 16 μ long, on about sternite 8; first ventral 38 μ long, on about sternite 17; second ventral 14 μ long, on about sternite 30; third ventral 17 μ long, on sternite 5 from rear; accessory seta present. Female genitalia 17 μ wide, 12 μ long, coverflap with 8 or 9 longitudinal furrows; seta 7 μ long.

Type locality: Fallen Leaf Lake, El Dorado County, California. **Collected:** September 13, 1951, by the writer. **Host:** *Acer glabrum* Torr. Sierra Maple. **Relation to host:** These mites are found in and perhaps cause the purplish-red erineum on the leaf tips. **Type slide:** So designated with the above data. Paratype slides: six in number as above. The attractive magenta erineum which tips these maple leaves is formed of hollow capitate 'hairs' within which is the colored fluid. Slides of the mite population from this erineum disclose at least four forms. Two of these, separable on foretibial and shield structures, appear later in this article. *Aceria calaceris* is the most plentiful mite of its type in this September-collected material, but another mite form with leg structures like *calaceris* is present as a minority of the population. This latter form, males and an occasional female, does not have as much difference in the tergite-sternite relationship as does the described form, and both sexes of this latter are completely microtuberculate. We may therefore be dealing with a case of deuteroecy, which needs further investigation. The relation that these mites bear to those forming red maple leaf erineum in other parts of the Northern Hemisphere remains to be elucidated. The foretibial structure of these *Aceria* species is important; the tibia of our California species is short with a minute seta near the base on the inner-side of the front. Previous authors that have described maple erineum mites have not touched on this point.

PHYLLOCOPTINAE**Phyllocoptini*****Vasates glabri* Keifer, new species**

Plate 213

Female 170 μ long, 55-60 μ thick, chunky, yellowish. Rostrum 24 μ long, curved down. Shield 34 μ long, 45 μ wide, shield lobe over rostrum base short; shield design a network: median line discontinuous, admedians branched with submedians; dorsal tubercles on rear margin, 28 μ apart, the dorsal setae projecting 23 μ to the rear. Foreleg 33 μ long, tibia 8 μ long, with prominent seta; tarsus 7 μ long, claw 8 μ long; featherclaw 4-rayed. Hindleg 30 μ long, tibia 6 μ long, tarsus 6 μ long, claw long, tapering, slightly knobbed, 8 μ long. Abdomen with each tergite broad enough to cover about two sternites; tergites with elongate microtubercles; sternites with elliptical microtubercles; 28 tergites, 50 sternites. Lateral seta 20 μ long, on about sternite 8; first ventral 37 μ long, on about sternite 19; second ventral 17 μ long, on about sternite 31; third ventral 19 μ long, on sternite 6 from rear; accessory seta present. Female genitalia 20 μ wide, 15 μ long, coverflap with about 8 longitudinal furrows; seta 15 μ long.

Male not seen.

Type locality: Fallen Leaf Lake, El Dorado County, California. **Collected:** September 13, 1951, by the writer. **Host:** *Acer glabrum* Torr. (Aceraceae), Sierra maple. **Relation to host:** The mites are part of the population complex in the magenta-colored leaf erineum. **Type slide:** So designated with the above data. Paratype slides: five in number as

above. This mite is presumably an inquilin if we are to attribute the formation of the erineum to the *Aceria* species described above. These maple leaves have so far not disclosed the presence of a leaf vagrant living on the open leaf surface.

Vasates paraglabri Keifer, new species

Plate 214

Female 165 μ long, 50 μ thick, somewhat wormlike, yellowish. Rostrum 20 μ long, curved downward. Shield 35 μ long, 33 μ wide; anterior lobe over rostrum short; design a network; the median line present only to rear, admedian and submedian lines branched and running together; dorsal tubercles on rear margin, 22 μ apart, the setae projecting backwards 26 μ . Foreleg 32 μ long, tibia 7 μ long with a prominent seta; tarsus 7 μ long, claw 8 μ long, tapering, slightly knobbed; featherclaw 4-rayed. Hindleg 27 μ long, tibia 5 μ long, tarsus 6 μ long, claw 7 μ long. Abdomen with about 60-65 rings, even dorsoventrally, with a few more tergites; microtubercles present on all parts of abdomen. Lateral seta 23 μ long, on about sternite 8; first ventral 36 μ long, on about sternite 19; second ventral 16 μ long, on about sternite 32; third ventral 20 μ long, on about sternite 5 from rear; accessory seta present. Female genitalia 20 μ wide, 14 μ long, coverflap with 8-9 longitudinal furrows; seta 11 μ long.

Male not seen.

Type locality: Fallen Leaf Lake, El Dorado County, California. **Collected:** September 13, 1951, by the writer. **Host:** *Acer glabrum* Torr, Sierra maple. **Relation to host:** The mites are inquilines in the magenta leaf erineum. **Type slide:** So designated with the above data. Paratype slides: five in number, as above. *Vasates glabri* and *paraglabri* are two of the four types of mites in the population complex in the magenta-colored maple leaf erineum. The tibial structure of these *Vasates* species is one of the easiest ways to separate them under the microscope from the *Aceria* species. The two *Vasates* species are separable first on the tergite-sternite relationship and also on the shield patterns. These characters are amply shown in the illustrations. These characters seem to preclude the idea that these may be but phases of one *Vasates* species. Hodgkiss (N. Y. Agr. Exp. Sta. Tech. Bul. 163, July 1930) has figured *Vasates* spp. inquilin in red maple erineum in the Eastern United States, but these figures indicate the species are different from the ones described above.

Epitrimerus abietis Keifer, new species

Plate 215

Female 190 μ long, 70 μ wide, 45 μ thick, yellowish, spindleform shape. Rostrum 40 μ long, projecting diagonally down. Shield broad triangular with prominent acute lateral lobes; anterior lobe over rostrum broad; central lines distinct, the median present, admedians curved, submedian lines joining toward rear with dorsal tubercles; dorsal tubercles 25 μ apart, ahead of rear margin; setae 5 μ long, projecting up. Legs with femoral setae present; foreleg 40 μ long, tibia 10 μ long, tarsus 8 μ long, claw 8 μ long with apical knob. Hindleg 37 μ long, tibia 8 μ long, tarsus 7 μ long, claw 7 μ long, featherclaw 5-rayed. Coxae just touching centrally. Abdomen with 33 tergites, and about 80-85 sternites; the tergites without microtubercles and with a subdorsal shallow furrow on each side; sternites with fine microtubercles. Lateral seta 23 μ long, on about sternite 12; first ventral 35 μ long, on about sternite 33; second ventral 25 μ long, on about sternite 54; third ventral 23 μ long, on about sternite 7 from rear; accessory seta absent. Female genitalia 30 μ wide, 20 μ long, coverflap with about 20 longitudinal furrows, somewhat irregular, basal fine striations; seta 16 μ long.

Male not studied.

Type locality: Fallen Leaf Lake, El Dorado County, California. **Collected:** September 12, 1947, and September 13, 1951, by the writer. **Host:** *Abies concolor* L. & G., (Pinaceae), White fir. **Relation to host:** The mites are needle vagrants, appearing late in the season on fresh growth. **Type slide:** As above, dated September 12, 1947. Paratype slides: ten in number, with six bearing the date September 12, 1947, and four dated September 13, 1951. This is the first *Epitrimerus* recorded on fir. It is distinguished in part by the sharp lateral shield lobes.

***Epitrimerus cupressifoliae* Keifer, new species**

Plate 216

Female 180 μ long, 55 μ wide, 45 μ thick, spindleform, brownish. Rostrum 31 μ long, curved down. Shield 50 μ long, 45 μ wide, lobe over rostrum somewhat acute; shield design of obscure lines; dorsal tubercles 20 μ apart, ahead of rear margin; dorsal setae 10 μ long, projecting up and inward. Legs with femoral setae; foreleg 34 μ long, tibia 9 μ long, with seta placed nearer apex; tarsus 7 μ long, claw 7 μ long, featherclaw 6-rayed. Hindleg 30 μ long, tibia 7 μ long, tarsus 7 μ long, claw 7 μ long. Forecoxae barely touching at base, slightly granular. Abdomen with 33 tergites that in some specimens have obscure elongate microtubercles; tergites forming a broad central ridge and a series of lateral lobes with a furrow between. Sternites 47 in number, microtuberculate. Lateral seta 27 μ long, on sternite 10; first ventral 23 μ long, on sternite 27; second ventral 15 μ long, on about sternite 45; third ventral 15 μ long, on about sternite 5 from rear; accessory seta absent. Female genitalia 30 μ wide, 22 μ long, coverflap with about 6 diagonal furrows, three converging from each side; seta 17 μ long.

Male not studied.

Type locality: Occidental district (county dumps), Sonoma County, California. **Collected:** September 2 and 6, 1951, by J. P. Keifer and the writer. **Host:** *Cupressus sargentii* Jepson (Cupressaceae), Sargent cypress. **Relation to host:** These mites lurk in the crevices of the scale-like leaves on the vigorous growing tips. **Type slide:** As above, bearing the date September 6th. Five paratype slides, four of which are dated September 2d and the other September 6th. A mite that is apparently identical to this one was collected by the writer on *Juniperus californicus* Carr. on Mt. Diablo, September 20, 1951, and on the same host in the Phelan district of San Bernardino County, October 5, 1951. The generic placement of this mite is admittedly uncertain. Conifer mites tend to have peculiarities, which while not definite enough to define readily, nevertheless make them taxonomic problems.

***Calacarus tejonis* Keifer, new species**

Plate 217

Female 160-165 μ long, 50 μ wide, 50 μ thick, robust, purple; in life with five longitudinal stripes of white wax on dorsal half of abdomen, and wax on the elliptical shield carina. Rostrum 45 μ long, projecting down. Shield 53 μ long, 51 μ wide, with a rather short, broad lobe over rostrum; design a longitudinal elliptical carina around the center, open anteriorly; dorsal tubercles indicated, 30 μ apart and ahead of the rear margin; dorsal setae missing. Legs with femoral setae present; foreleg 40 μ long, tibia 9 μ long, tarsus 9 μ long, claw 7.5 μ long, slender, slightly knobbed; featherclaw 7-rayed. Hindleg 33 μ long, patellar seta absent, tibia 6 μ long, tarsus 7 μ long, claw 9 μ long. Forecoxae broadly spread and hardly touching. Abdomen with five longitudinal wax-bearing ridges on dorsal half, with slight furrows in between; 55-60 tergites; 60-70 sternites; sternites with fine microtubercles. Lateral seta 35 μ long, on about sternite 10; first ventral 35 μ long, on about sternite 25; second ventral 28 μ long, on about sternite 44; third ventral 22 μ long, on about sternite 6 from rear; accessory seta missing. Female genitalia 34 μ wide, 20 μ long, coverflap smooth; seta 25 μ long.

Male not seen.

Type locality: Fort Tejon, Kern County, California. **Collected:** November 20, 1951, by the writer. **Host:** *Quercus lobata* Nee, (Fagaceae), Valley Oak. **Relation to host:** The mites are upper surface vagrants on the leaves. **Type slide:** So designated and bearing the above data. Four paratype slides as above. The other species in California referable to this genus are *adornatus* (K.) on Camellia, and *pulviferus* K. on Kellogg oak. Both of these species have a considerably more elaborate shield pattern than the new species.

Anthocoptes pickeringiae Keifer, new species

Plate 218

Female 160-170 μ long, 40-45 μ thick, orange color, spindleform. Rostrum 30 μ long, projecting down. Shield 30 μ long, 44 μ wide, with a moderately broad lobe over rostrum base; design a network with the median line obsolete, the submedian lines forming most of the pattern; dorsal tubercles 25 μ apart, on rear margin; dorsal setae projecting backward 30 μ . Legs with femoral setae; foreleg 30 μ long, tibia 7 μ long, tarsus 7 μ long, claw 7 μ long, slightly knobbed; featherclaw 7-rayed. Hindleg 30 μ long, tibia 6 μ long, tarsus 7 μ long, claw 7 μ long. Anterior coxae connate, the coxae somewhat granular. Abdomen with 14 tergites, all but the posterior three of which are very broad; tergites with slight microtuberculation on the rear margins; sternites completely microtuberculate, 55 in number. Lateral seta 18 μ long, on about sternite 7; first ventral 32 μ long, on about sternite 18; second ventral 10 μ long, on about sternite 34; third ventral 12 μ long, on about sternite 5 from rear; accessory seta absent. Female genitalia 23 μ wide, 12 μ long, coverflap with about 14 longitudinal furrows; seta 25 μ long.

Male 150 μ long, 40 μ thick.

Type locality: Occidental, Sonoma County, California. **Collected:** September 6, 1951, by the writer. **Host:** *Pickeringia montana* Nutt. (Leguminosae), Pea chaparral. **Relation to host:** The mites are vagrants on the leaves and green stems. **Type slide:** So designated with the above data. Six paratype slides also bear this data. The seven-rayed featherclaw is one of the distinguishing features for this mite; no other California species has more than five rays.

PHYLLOCOPTINAE**Diptilomiopini****Asetacus** Keifer, new genus

Body robust-spindleform. Rostrum large, set at right angles to the body and tapering; chelicerae projecting forward a short distance, then abruptly bent downward, with a further slight curve above middle of verticle portion. Shield broad; lobe over rostrum base short and broad, emarginate; dorsal tubercles indicated ahead of rear shield margin, but dorsal setae missing. Anterior coxae with a sharp ridge between. Legs long and slender; femoral setae missing, but other usual setae present; tibiae long and slender, with foretibial seta; featherclaw simple. Abdomen with narrow rings, the tergites almost as numerous as the sternites. Female genitalia with coverflap bearing a double rank of short furrows.

Genotype: *Asetacus madronae*, new species.

Asetacus madronae Keifer, new species

Plate 219

Female 200 μ long, 70 μ thick, very light yellow in color with a white pulverulence when living. Rostrum 65 μ long, tapering. Shield 50 μ long, 60 μ wide, the anterior lobe broadly knotted centrally; design of irregular longitudinal lines but indicating median and admedian lines; submedian lines shorter and separated laterally; dorsal tubercles indicated but bearing no setae. Foreleg 58 μ long, patellar seta present, tibia 15 μ long, tarsus 12 μ long, claw 10 μ long, featherclaw 6-rayed. Hindleg 49 μ long, patellar seta present, tibia 11 μ long, tarsus 11 μ long, claw 11 μ long. Abdomen with 80-85 tergites which are narrow but lack microtubercles; sternites 95, microtuberculate. Lateral seta 38 μ long, on about sternite 14; first ventral 48 μ long, on about sternite 30; second ventral 30 μ long, on about sternite 66; third ventral 45 μ long, on sternite 9 from rear; accessory seta absent. Female genitalia 38 μ wide, 28 μ long, coverflap with about 14 longitudinal furrows in two ranks; seta 20 μ long.

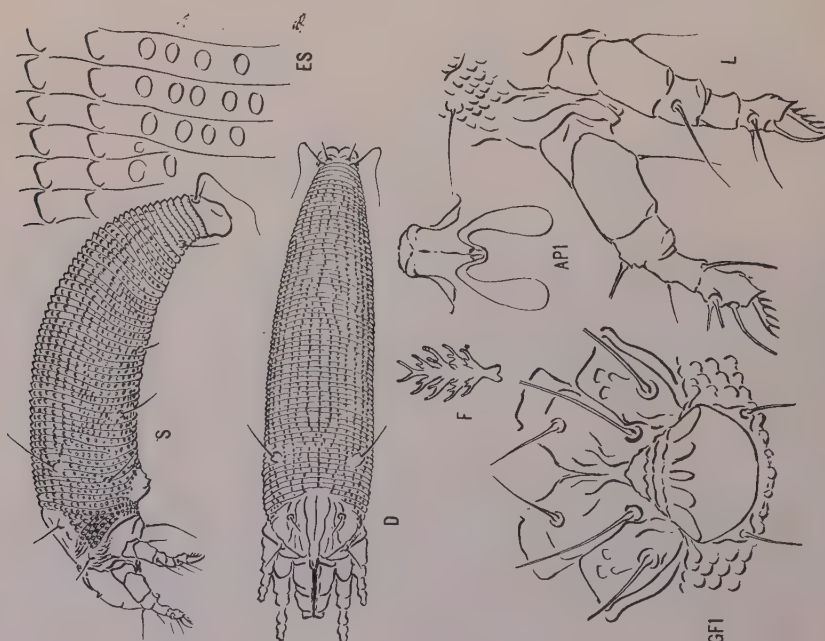
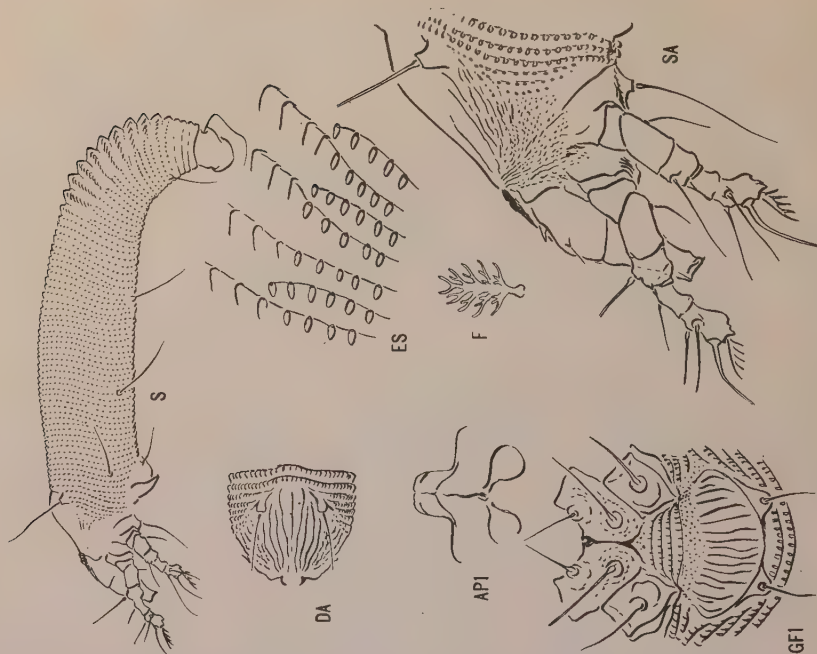
Male not studied.

Type locality: Duncans Mills district (Russian River), Sonoma County, California. **Collected:** September 4, 1951, by the writer. **Host:** *Arbutus menziesii* Pursh. (Ericaceae), Madrone. **Relation to host:** The mites are undersurface leaf vagrants. **Type slide:** So designated with the above data. Eight paratypes also bear this data. The new genus and

species occupy a position in this tribe part way between the genera with simple featherclaws and no sharp ridge between the forecoxae, and those which have divided featherclaws. This is the first genus with simple featherclaws to lack the dorsal setae. The name of the genus is a contraction of "asetae," without setae, and *Acarus*.

DESIGNATIONS ON PLATES

- AP1—Internal female genitalia
- D—Dorsal view of mite
- DA—Dorsal view of anterior section of mite
- ES—Detail of side skin
- F—Featherclaw
- GF1—Female genitalia and coxae from below
- L—Left legs
- S—Side view of mite
- SA—Side view of anterior section of mite

Plate 210—*Anchiphytotopus lineatus*, n. sp.Plate 211—*Pareria frenontiae*, n. sp.

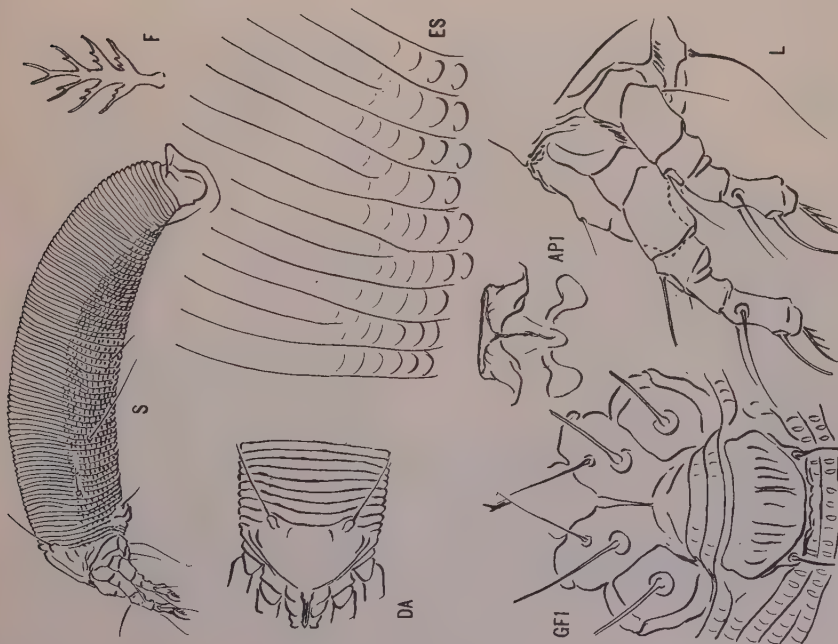


Plate 212—*Acerka calaceris*, n. sp.

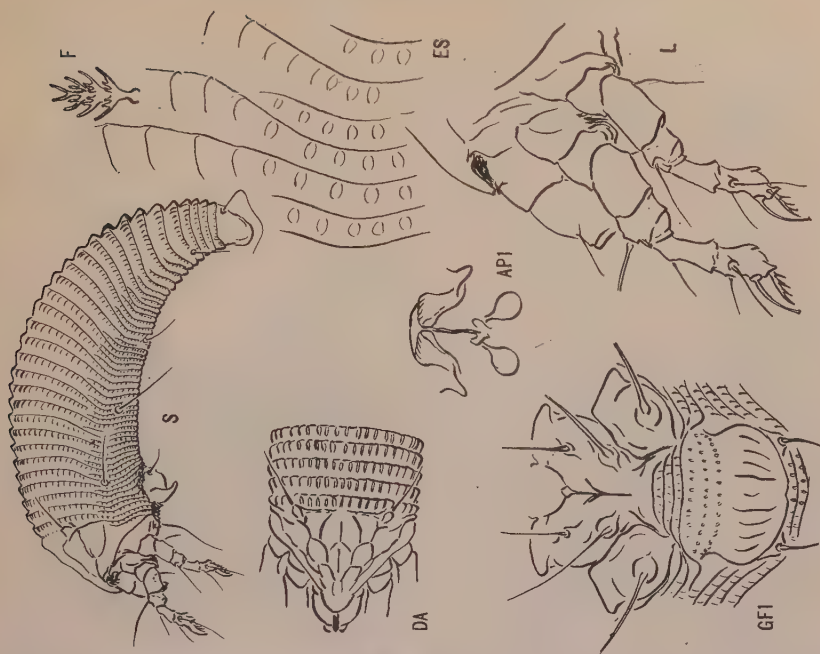
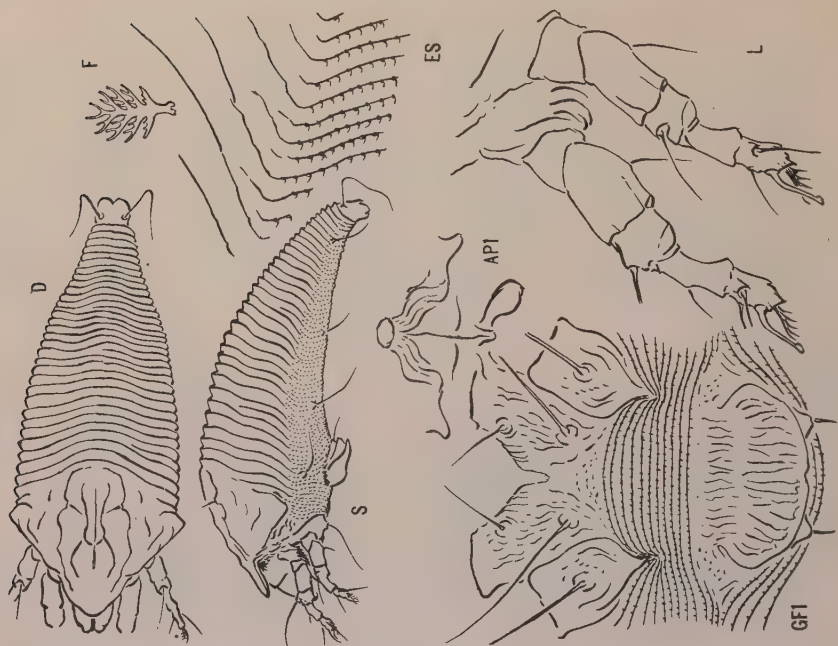
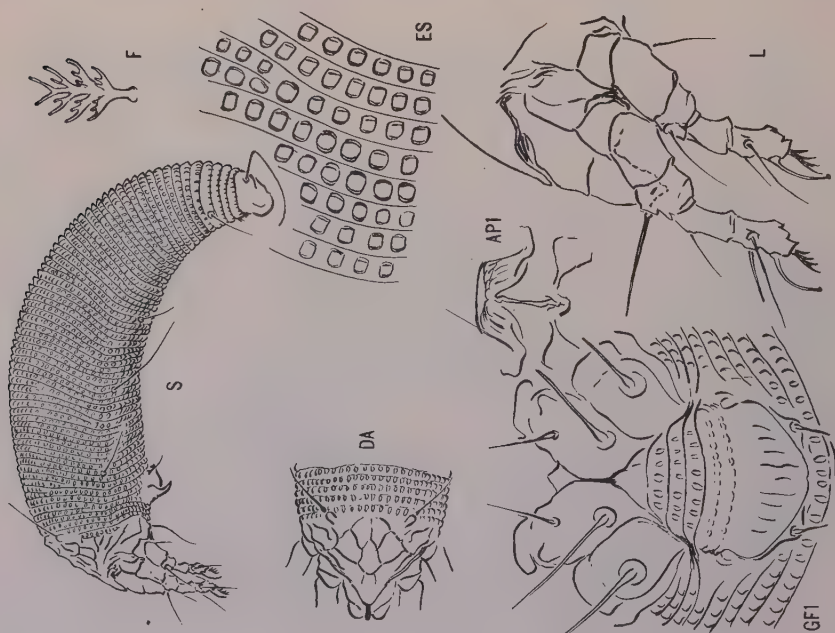


Plate 213—*Vascates glabri*, n. sp.

Plate 215—*Egitrimerus obiectis*, n. sp.Plate 214—*Vasates paraglabri*, n. sp.

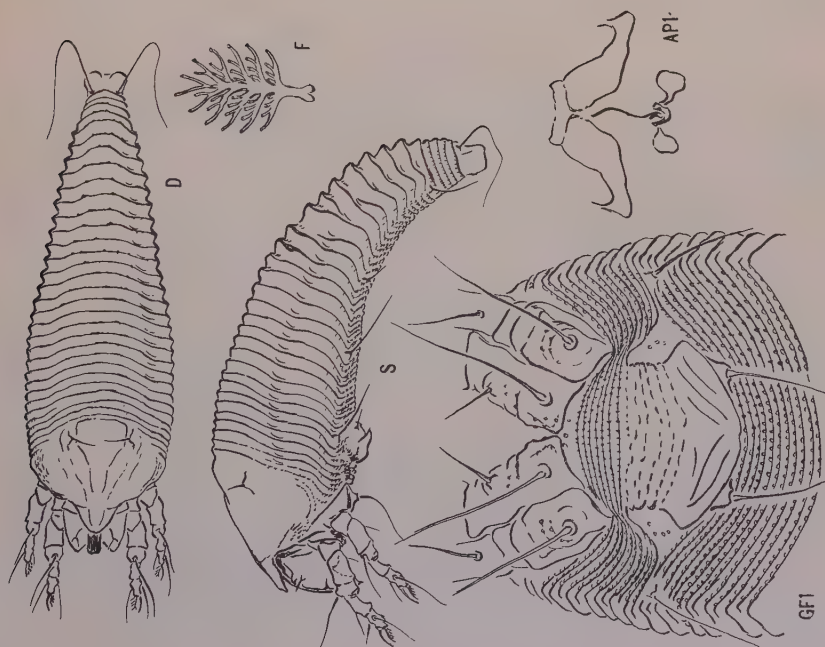
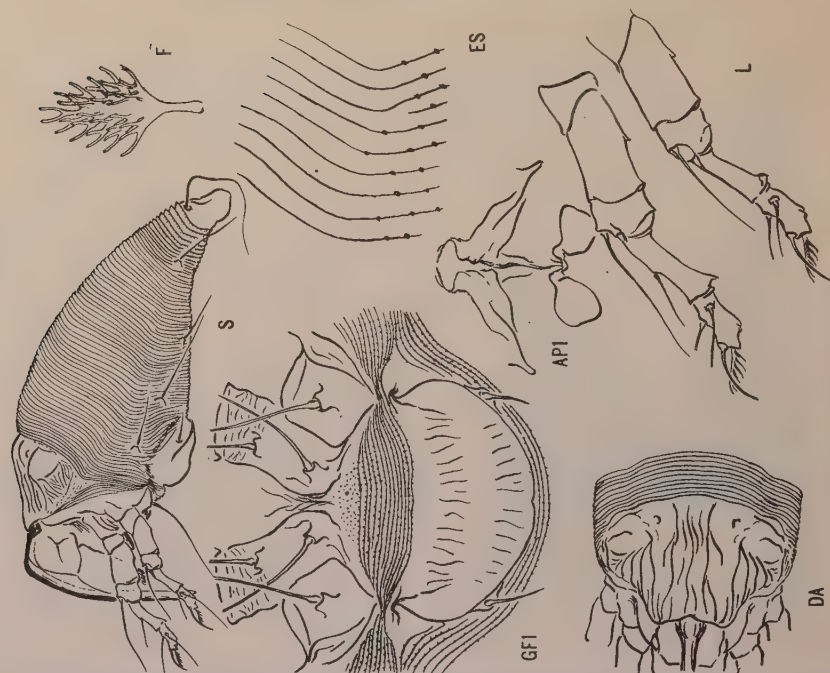


Plate 216—*Epitimerus cupressifoliae*, n. sp.



Plate 217—*Calacarus tejoni*, n. sp.

Plate 219.—*Asetacus madronae*, n. sp.Plate 218.—*Anthocoptes pickeringiae*, n. sp.

GORSE¹ CONTROL

By MURRAY R. PRYOR AND RICHARD H. DANA

Bureau of Rodent and Weed Control and Seed Inspection, State Department of
Agriculture, Sacramento, California

Gorse, a leguminous shrub somewhat resembling Scotch broom² in general appearance, menaces grazing lands in six California coastal counties including Santa Cruz, Marin, Sonoma, Mendocino, Humboldt and Del Norte. A recent survey reveals approximately 15,350 acres of land are now infested, and that the infestation is steadily increasing.

This aggressive shrub, densely branched and heavily armored with sharp pubescent spines, reproduces from seeds and creeping roots. The numerous seeds are formed in dehiscent pods which burst open at maturity discharging their contents for many feet. The divergent, dark-green stems are without foliage in the ordinary sense of the word. The modified foliage bristles from the stems as pubescent spines. This peculiar character of the plant makes it difficult to wet with chemical sprays. Gorse is readily distinguished from other shrubbery at a considerable distance by its profusion of yellow blossoms. The bright-hued flowers are usually produced in clusters toward the ends of the branches and dense stands of gorse may be seen covering roadsides, fields and hills like a yellow conflagration. In California, gorse blooms from midwinter to early fall.

This striking and attractive shrub was introduced from the Old World. At first it was greatly prized as an ornamental, but ranchers no longer esteem it as such, as escaping from its ornamental settings it unobtrusively spread to nearby grazing lands. Unhindered, gorse progressively encroached upon valuable agricultural lands to a point where spread of the plant was viewed with alarm. The details of the original introduction of gorse are obscured in history, but a case in Marin County will serve to show how the plant got its foothold on a ranch near Tomales. The authors were informed by the owners that over 40 years ago, their father, upon returning from a visit to his homeland, had brought back a few plants of gorse, as "a bit of ol' Ireland." These *few plants* over the years have been the source of large infestations at several places on this property. The owners are now confronted with a serious range pest and an expensive control program.

Gorse, relatively high in plant resins, is highly inflammable and dense stands or brush-fields when ignited burn furiously. Spread has been retarded by burning the brush fields but this method is only a partial expedient in the control program.

¹ *Ulex europaeus* L. Commonly known as Gorse or Irish Furze.

² *Cytisus scoparius* (L.) Link.

Areas infested with gorse which can be cultivated may be handled in a manner to combine burning and cultivation. The recommended procedure is to eliminate as much of the gorse as possible by burning when weather and atmospheric conditions are conducive to building up a hot fire. Care should be taken concerning the rules and regulations relative to burning brush lands and fire prevention measures should be observed. More than ordinary precaution is required in burning gorse near buildings or any property that might be destroyed as fire will sweep through gorse with great speed, burning with unabated fury until the stand thins out or a natural barrier is reached. Even though burning may be hazardous it is a preliminary operation that is quite essential in the control program. Heavy stands of gorse are inaccessible, and if not burned are nearly impossible to control by cultivation or chemical sprays. In removing the roots of the burned plants from the burned-over areas heavy cultivation equipment, such as a trac-layer tractor, and heavy mold-board plows will be required. A "bull-dozer" accessory mounted on the tractor will facilitate the piling of debris so that it may be readily burned. After the land is cleared it should be farmed. A farming program which includes hay or grain production for a period of years will destroy the gorse seedlings and eventually the land may be turned back to grazing.

It was in the summer of 1947 that the senior author of this article first conducted chemical tests for the control of gorse, using several forms of 2,4-dichlorophenoxyacetic acid (2,4-D). The ester and amine forms were applied in aqueous solution as a wetting foliage spray. The test plots were established at the county fairgrounds near Crescent City in cooperation



FIGURE 1. Gorse, *Ulex europaeus*

with Lowell Mobley, then Agricultural Commissioner of Del Norte County. Subsequent observation revealed the 2,4-D treatments to be ineffectual and further exploration of this material was abandoned. Shortly after 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) came into general use, further tests on gorse were conducted in Humboldt, Marin, and Mendocino Counties. This chemical proved quite effective in killing gorse when applied in the proper form, amount and manner.

The ester forms of 2,4,5-T were found satisfactory for gorse control whereas the amine form applied at similar rates had little or no toxic effect on the treated plants. In the ester series the toxicity of the old standard esters, such as the isopropyl form, was comparable to the newer so-called lower volatile esters. It was not definitely proven, but the latter series appeared to be somewhat more positive in action. The amount of material applied proved to be the most important factor.

For the chemical control of gorse with 2,4,5-T it is recommended that a solution of 4,000 parts per million, or 3.34 pounds of 2,4,5-T acid equivalent in 100 gallons of water as an ester be applied to the plants as a foliage spray. Care should be taken to thoroughly wet *all* the foliage to insure satisfactory control results. The addition of an aromatic weed oil plus an emulsifying agent increased the effectiveness of the treatment in the spray trials and greatly hastened the operation as the treated surfaces were more readily covered with spray solution. Five gallons of oil as an additive to make up 100 gallons of aqueous solution gave good wetting and absorption. A lesser amount of oil might have given comparable results. It is advised that the newer so-called lower volatile ester formulations be used in preference to the older forms. It is further suggested that the above-mentioned dosage rate be adhered to. Lesser amounts give variable results. Rates higher than the recommended dosage gave for all practicable purposes no better results.

For optimum results application should be made when the plants are actively growing; however, very good results may be obtained by treating plants in late season.

To be practicable the chemical control of gorse should be combined with the burning method. Gorse brush-fields are usually inaccessible and therefore would not permit the effective use of chemicals. As the mature plants expose a much greater surface to be treated, and would greatly increase the expense of spraying, the problem resolves itself into burning the brush-fields and spraying the seedlings and the regrowth or basal sprouts of the gorse plants. It is believed that for the best results these basal sprouts should be two or three feet in height when sprayed. Probably late fall burning of a gorse stand would not give sufficient time to produce this much regrowth and a spraying in the second year following the burning would seem advisable. The chemical control program would obviate cultural control and would be very practical for eliminating gorse from hilly land, steep ravines and areas subject to erosion. None of the above-mentioned control methods will give lasting results if only employed a year or two. In most cases a number of years will be required to satisfactorily control gorse.



CURRENT INSECT NOTES

H. M. ARMITAGE
STATE DEPARTMENT OF AGRICULTURE

This is the second article in this series of notes which make available current information on California insects and mites which are of economic importance, specimens of which have been processed through the identification laboratory of the Bureau of Entomology.

The pink bollworm of cotton, *Pectinophora gossypiella*, is not known to occur in California but so much publicity was given to the recent finding of live larvae in cotton seed contaminating a mechanical picker brought into the State from the infested area in Texas that the facts might be worth while reporting here. The machine in question had passed through two steam sterilizations, one at point of origin in Texas and the other at Bakersfield on arrival in California. Cotton bolls found in the "shoe" of the picker by C. S. Morley, Deputy Agricultural Commissioner of Kern County, contained live larvae. Apparently the infested cotton had been shielded against the live steam. As a result, not only this machine, but all others which had entered the State from the pink bollworm infested area were immediately fumigated as a precautionary measure, using methyl bromide or cyanide. This method and these materials have now replaced steam sterilization as officially approved measures. Several hundred machines were involved as delivered in the several San Joaquin cotton producing counties. One of the other machines examined in Kern County prior to fumigation also carried a single live larvae under similar conditions, fully justifying the safeguard measures taken. There is no reason to believe that any escapes resulted prior to these findings, though they could have occurred later had the larvae completed their life cycle. The new approved method of treatment of such equipment is deemed fully adequate to safeguard against any such further opportunity.

The Australian sod fly, *Metoponia rubriceps*, was first reported in California by Dr. E. L. Kessel, of the University of San Francisco, who found it infesting lawns in Golden Gate Park on November 30, 1948. It has since been under observation by the department. It has reappeared annually in increasing numbers in the same general vicinity where first found. However, some outward spread has been recorded in 1951. In October, at the time of its normal fall flight, Dr. H. T. Osborn and R. P. Allen, of the department, recorded spread south on Sunset Boulevard in San Francisco as far as Taraval Street, approximately two miles from Golden Gate Park, and also in the Presidio to the north. It was also found on the grounds of the city and county hospital west of Twin Peaks. It is recorded as a pest of maize in Australia only when planted on newly plowed, previously infested sod land. While larvae are abundant in the sod and areas where found in San Francisco, infesta-

tion has as yet shown no visible economic damage. Its lack of serious previous economic history and rather wide distribution when first found here precluded any control measures, except at the local level if found desirable.

The chrysanthemum semibud mite, *Paraphytoptus chrysanthemi*, was first collected in California at Hanford, in Kings County, by L. O. Haupt, Agricultural Commissioner, in September, 1939. Recently this species has attracted attention in Orange County as a potential pest of chrysanthemum. Investigation at Orange in company with D. H. Byers, County Agricultural Inspector, showed these mites to be very common on chrysanthemum in early October, 1951. They were found to inhabit the green surfaces of the plant, finding protection under the surface hairs. They were also found in the petiole bases and under the sepals at the base of flowers where they cause a certain amount of browning of the surface tissue and if numerous enough could result in malformed or dried up flowers. Further investigation has shown this mite to occur in Los Angeles and Sacramento Counties, the host always being chrysanthemum.

A mealybug, *Spilococcus* sp., was submitted by San Diego County Inspector George W. Schwegel from mistletoe collected December 4, 1951, in the Jacumba district of San Diego County. This appears to be a new species. According to H. H. Keifer, the genus *Spilococcus* is a group of mealybugs that have six or eight representatives in California. The only one of these of any potential economic importance is the Sequoia mealybug which infests redwood and cypress.

The African earwig, *Euborellia cincticollis*, which has been under observation in the Imperial Valley for the past two years was reported by Stewart Lockwood on October 25, 1951, in considerable numbers under baled alfalfa held in the field in the Niland area. This species has been credited with causing rind injury to melons at the point of contact with the ground, where this species has a habit of hiding out.

A plume moth, *Platyptilia pica* sub. sp. prob. *monticola*, was submitted by the county agricultural commissioner's office October 1, 1951, from Stockton where it was reported causing serious damage to buds of geranium.

Comparison of specimens of the citrus bud mite, *Aceria sheldoni*, collected at El Toro, Orange County, by H. H. Keifer and D. H. Byers, with mite specimens received from Professor E. De Martini, Acireale, Sicily, and a second submission by Dr. A. M. Boyce from Rhodesia, South Africa, show them to be one and the same. This would appear to extend the range of this species to Mediterranean regions and to South Africa.

For the first time navel orange worm, *Myelois venipars*, has been taken infesting walnuts in Stanislaus County. During October, November, and December, 1951, Deputy Commissioner L. E. Macomber states that it has been repeatedly intercepted in this host as brought in for processing at Modesto.

The Carolina grasshopper, *Dissosteira carolina*, was submitted by Robert Harper, of the department, from range plants at Douglas City, Trinity County, on August 29, 1951. While normally a minor pest throughout the United States, this species is recorded chiefly because of its rarity in California.

The black cherry fruit fly, *Rhagoletis fausta*, was submitted by Dr. H. T. Osborn representing specimens collected September 7, 1951, on *Prunus emarginata* in Plumas County 11 miles south of Susanville at an elevation of 6,500-7,000 feet. This is the first record of the species as occurring in this county.

First submitted by R. A. Break, Farm Advisor of Fresno County, in 1951 specimens of the Boysenberry bud mite, *Aceria orthomera*, were received December 4, 1951, from Enoch Torpen, of the Sonoma County Farm Advisor's office, taken on the same host at Sebastopol. This is the most northerly record of this species. Other collections indicate that it occurs on native blackberry in Sacramento and Alameda Counties. This mite resembles the redberry mite of Himalaya blackberries but does not cause a redberry condition on boysenberry as it does on the former.

The fern mite, *Hemitarsonemus tepidariorum*, was submitted by A. E. Pritchard, of the University of California, from Pteris ferns being grown under glass in a local nursery in San Francisco. Specimens were collected March 15, 1951. This is a first record for California, its previous known range being England and Minnesota. Apparently nurserymen in San Francisco have noted the severe leaf crumpling caused by this mite for a number of years, but the reason was not recognized until the finding made by Dr. Pritchard. The species would appear to be too widespread to merit eradication but is sufficiently serious to suggest local intensive control measures where found.

What appears to be a new species of mealybug, *Puto* sp., was submitted by Otto Schwab, entomologist in Monterey County Agricultural Commissioner's office, from weed hosts in Soledad in Monterey County. The mealybugs occurred on a rather wide range of weeds paralleling a finding of tomato and white beans. There was some migration into the latter fields and fear that the infestation might cause serious losses. Later, however, it was determined that infestation was due to population pressure rather than attractiveness of the host and there seems little possibility of either of these economic crops being primary hosts. There are only four other species of *Puto* present in California.

The Lewis redmite, *Brevipalpus lewisi*, has attracted economic attention in California for several years due to the fact that it damages oranges both in Tulare and Butte Counties. It was first reported from Tulare County in 1942. Recently H. H. Keifer reported taking this mite on alder in the Folsom District of Sacramento County August 18, 1951, and on mistletoe on cottonwood in the Shafter District of Kern County November 19, 1951. The mite is assumed to be native to California and the two wild hosts cited, which occur generally throughout the State, could easily serve as a reservoir in building up the species to the point where it might be a serious pest of citrus and possibly other hosts in areas where it has not yet been recorded.

A mealybug, *Trionymus* sp., was found heavily infesting the roots of Haanchen barley by W. E. Huse, of the Siskiyou County Agricultural Commissioner's office, in the Tulalake District in Siskiyou County August 15, 1951. Mealybugs were found in abundance and resulting honeydew was seriously fouling up the harvester. This instance apparently represents an undescribed species which has been submitted to Professor G. F. Ferris for study.

The first Japanese beetle, *Popillia japonica*, to be taken in California, was submitted by Los Angeles County Agricultural Inspector Dearborn from one of several traps located and regularly serviced each year in the approach area to the Los Angeles Municipal Airport at Mines Field, Inglewood. The specimen was a female devoid of eggs and is presumed to present a transient dropped from an approaching eastern plane as the wheels were dropped coming in for a landing. As a precautionary measure all soil within a 300-foot radius of the trap was treated with chlordane, in conformity with the federal policy. It is not believed that an established infestation is represented by this finding.

A cockroach, *Supella supellectilium*, was first recorded in California in San Bernardino County in 1940 by Agricultural Commissioner John P. Coy. In the spring of 1951, R. W. L. Potts, Department Entomologist at San Francisco, reported it at Palo Alto; on May 21st, W. Duncan, Solano County Agricultural Inspector, reported it at Vacaville. These last two are probably the first records of the occurrence of this species in Northern California. The earliest records covering its history in the United States show it as first appearing in Miami, Florida, in 1903. Since then it has been reported as far north as Illinois and Nebraska.

The sweet gumscale, *Diaspidiotus liquidambaris*, was submitted on June 11, 1951, by L. E. Myers, entomologist with the Los Angeles County Agricultural Commissioner's office, infesting sweetgum in Rivera. This infestation represents a considerable jump from a previous record at Atwater, Merced County, in 1942. In view of the intervening period it may have spread to other areas but has not, until the last mentioned date, attracted attention. The native home of this scale is in the Mississippi Valley where sweetgum is native, and also along the Atlantic Coast. It attacks the twigs and leaves producing a small gall on the latter at the position of the scale.

Specimens of the migratory grasshopper, *Melanoplus rugglesi*, were collected by H. H. Keifer and Loring White, Modoc County Agricultural Commissioner, June 13, seven miles east of Cedarville, and on June 14th three miles east of Likely in Modoc County. This species has attracted considerable attention during the past several years as representing a large population developing in southern Nevada and moving northward into Oregon and just cutting the northeast corner of California. The first record here cited apparently comes from a band not previously known to exist with relation to the general movement, though they were observed as roughly proceeding in the same northerly direction, into the wind, and parallel to the mountains. The second instance appears to represent stragglers previously found in parts of southern Modoc County and in northeastern Lassen County. There seems to be some question as to whether or not these stragglers can found permanent colonies.

